ISSN 0006 8241 = Bothalia

Bothalia

A JOURNAL OF BOTANICAL RESEARCH

Vol. 40,2 Oct. 2010

TECHNICAL PUBLICATIONS OF THE SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE PRETORIA

Obtainable from the South African National Biodiversity Institute (SANBI), Private Bag X101, Pretoria 0001, Republic of South Africa. A catalogue of all available publications will be issued on request.

BOTHALIA

Bothalia is named in honour of General Louis Botha, first Premier and Minister of Agriculture of the Union of South Africa. This house journal of the South African National Biodiversity Institute, Pretoria, is devoted to the furtherance of botanical science. The main fields covered are taxonomy, ecology, anatomy and cytology. Two parts of the journal and an index to contents, authors and subjects are published annually.

Three booklets of the contents (a) to Vols 1–20, (b) to Vols 21–25, (c) to Vols 26–30, and (d) to Vols 31–37 (2001–2007) are available.

STRELITZIA

A series of occasional publications on southern African flora and vegetation, replacing *Memoirs of the Botanical Survey of South Africa* and *Annals of Kirstenbosch Botanic Gardens.*

MEMOIRS OF THE BOTANICAL SURVEY OF SOUTH AFRICA

The memoirs are individual treatises usually of an ecological nature, but sometimes dealing with taxonomy or economic botany. Published: Nos 1–63 (many out of print). Discontinued after No. 63.

ANNALS OF KIRSTENBOSCH BOTANIC GARDENS

A series devoted to the publication of monographs and major works on southern African flora.Published: Vols 14–19 (earlier volumes published as supplementary volumes to the *Journal of South African Botany*). Discontinued after Vol. 19.

FLOWERING PLANTS OF AFRICA (FPA)

This serial presents colour plates of African plants with accompanying text. The plates are prepared mainly by the artists at the South African National Biodiverity Institute. Many botanical artists have contributed to the series, such as Fay Anderson, Peter Bally, Auriol Batten, Gillian Condy, Betty Connell, Stella Gower, Rosemary Holcroft, Kathleen Lansdell, Cythna Letty (over 700 plates), Claire Linder-Smith and Ellaphie Ward-Hilhorst. The Editor is pleased to receive living plants of general interest or of economic value for illustration.

From Vol. 55, twenty plates are published at irregular intervals. An index to Vols 1–49 is available.

FLORA OF SOUTHERN AFRICA (FSA)

A taxonomic treatise on the flora of the Republic of South Africa, Lesotho, Swaziland, Namibia and Botswana. the *FSA* contains descriptions of families, genera, species, infraspecific taxa, keys to genera and species, synonymy, literature and limited specimen citations, as well as taxonomic and ecological notes.

Contributions to the *FSA* also appear in *Bothalia.*

PALAEOFLORA OF SOUTHERN AFRICA

A palaeoflora on a pattern comparable to that of the *Flora of southern Africa*. Much of the information is presented in the form of tables and photographic plates depicting fossil populations. Now available:

Molteno Formation (Triassic) Vol. 1. Introduction. *Dicroidium*, 1983, by J.M. & H.M. Anderson.

Molteno Formation (Triassic) Vol. 2. Gymnosperms (excluding *Dicroidium*), 1983, by J.M. & H.M. Anderson.

Prodromus of South African Megafloras. Devonian to Lower Cretaceous, 1985, by J.M. & H.M. Anderson. Obtainable from: A.A. Balkema Marketing, Box 317, Claremont 7735, RSA.

Towards Gondwana Alive. Promoting biodiversity and stemming the Sixth Extinction, 1999, by J.M. Anderson (ed.).

Heyday of the gymnosperms: systematics and biodiversity of the Late Triassic Molteno fructifications, 2003, by J.M. Anderson & H.M. Anderson. *Strelitzia* 15.

Brief history of the gymnosperms: classification, biodiversity, phytogeography and ecology, 2007, by J.M. Anderson, H.M. Anderson & C.J. Cleal. *Strelitzia* 20.

Molteno ferns: Late Triassic biodiversity in southern Africa, 2008, by H.M. Anderson & J.M. Anderson. *Strelitzia* 21.

SANBI BIODIVERSITY SERIES

A series of occasional reports on projects, technologies, workshops, symposia and other activities initated by or executed in partnership with SANBI.

BOTHALIA

A JOURNAL OF BOTANICAL RESEARCH

Volume 40,2

Scientific Editor: G. Germishuizen
Technical Editor: B.A. Momberg

SOUTH AFRICAN
national
biodiversity
institute
SANBI

2 Cussonia Avenue, Brummeria, Pretoria
Private Bag X101, Pretoria 0001

ISSN 0006 8241

Oct. 2010

Editorial Board

D.F. Cutler	Royal Botanic Gardens, Kew, UK
B.J. Huntley	South African National Biodiversity Institute, Cape Town, RSA
P.H. Raven	Missouri Botanical Garden, St Louis, USA
M.J.A. Werger	University of Utrecht, Utrecht, The Netherlands

Acknowledgements to referees

Archer, Mrs C. South African National Biodiversity Institute, Pretoria, RSA.
Barker, Dr N.P. Botany Department, Rhodes University, Grahamstown, RSA.
Barkworth, Dr M. Intermountain Herbarium, Utah State University, Utah, USA.
Bremer, Prof. K. Department of Systematic Botany, University of Uppsala, Sweden.
Bridson, Dr D. 21 Ferrymoor, Ham, Richmond, Surrey, England, UK.
Burrows, J.E. Box 710, 1120 Lydenburg, RSA.
Cortez, Prof. V.G. Universidade Federal do Paraná, Jardim Dallas, Palotina, Brazil.
Cowling, Prof. R.M. Botany Department, Nelson Mandela Metropolitan University, Port Elizabeth, RSA.
Demoulin, Prof. V. Biodiversité végétale (algologie et mycologie), Liège, Belgium.
Du Preez, Prof. J. P.O. Box 11945, Bloemfontein, RSA.
Esler, Prof. K.J. Department of Conservation Ecology, University of Stellenbosch, RSA.
Fish, Mrs L. South African National Biodiversity Institute, Pretoria, RSA.
Gryzenhout, Dr M. University of Pretoria, RSA.
Jacobsen, Dr N. P.O. Box 671, Wilderness, Western Cape, RSA.
Klopper, Mrs R.R. South African National Biodiversity Institute, Pretoria, RSA.
Koekemoer, Dr M. South African National Biodiversity Institute, Pretoria, RSA.
Linder, Prof. H.P. Institute for Systematic Botany, University of Zürich, Switzerland.
Luckow, Prof. M.A. Department of Plant Biology, Cornell University, Ithaca, USA.
Mannheimer, Dr C. P.O. Box 193, Windhoek, Namibia.
Manning, Dr J.C. South African National Biodiversity Institute, Cape Town, RSA.
Nordenstam, Prof. R.B. Naturhistoriska Riksmuseet, Stockholm, Sweden.
Oliver, Dr E.G.H. Department of Botany & Zoology, University of Stellenbosch, RSA.
Retief, Dr E. South African National Biodiversity Institute, Pretoria, RSA.
Ross, Dr J.H. c/o Prof. D. Cantrill, Royal Botanic Gardens, Melbourne, Australia.
Simon, B. Queensland Herbarium, Brisbane Botanic Gardens, Queensland, Australia.
Smithies, Mrs S.J. South African National Biodiversity Institute, Pretoria, RSA.
Snijman, Dr D. South African National Biodiversity Institute, Cape Town, RSA.
Stirton, Dr C.H. National Botanic Garden, Llanarthne, Wales, UK.
Tilney, Prof. P.M. Department of Botany, University of Johannesburg, RSA.
Van Wyk, Prof. A.E. Botany Department, University of Pretoria, RSA.
Vinnersten, Dr A. Botanical Garden, Uppsala University, Sweden.
Welman, Ms W.G. South African National Biodiversity Institute, Pretoria, RSA.

Date of publication of *Bothalia* 40,1: 5 May 2010.

CONTENTS

Bothalia 40,2

1. *Moraea vuvuzela* and *M. intermedia* (Iridaceae–Iridoideae), two new species from western South Africa, and some nomenclatural changes and range extensions in the genus. P. GOLDBLATT and J.C. MANNING 147

2. Taxonomic notes on the Clathraceae (Phallales: Phallomycetidae) *sensu* Bottomley and a new key to the species in southern Africa. J.C. COETZEE 155

3. Two new species of *Nemesia* (Scrophulariaceae) from the southern Cape, South Africa. K.E. STEINER 161

4. Notes on African plants:

Asphodelaceae. *Bulbinella calcicola*, a new species from Saldanha Bay, Western Cape. J.C. MANNING and P. GOLDBLATT 197

Asteraceae. *Berkheya chrysanthemoides* and *Heterorhachis hystrix*, two new species of Arctotideae–Gorteriinae from the southwestern Cape. J.C. MANNING, P.O. KARIS, P. GOLDBLATT and N.A. HELME 185

Asteraceae. *Senecio comptonii* and *S. esterhuyseniae*, two new species of *Senecio sens. lat.* (Senecioneae) from the Cape Floristic Region. J.C. MANNING and P. GOLDBLATT 193

Colchicaceae. *Colchicum albofenestratum*, a new species from Namaqualand, South Africa. D.A. SNIJMAN and J.C. MANNING 175

Euphorbiaceae. A new name for *Euphorbia chamaeclada* from Angola. P.V. BRUYNS 178

Fabaceae. Taxonomic status of *Elephantorrhiza rangei* (Mimosoideae). A. GROBLER and A.E. VAN WYK 183

Iridaceae. *Geosiris albiflora* (Geosiridoideae), a new species from the Comoro Archipelago. P. GOLDBLATT and J.C. MANNING 169

Lycoperdaceae–Gasteromycetes. Taxonomic and nomenclatural notes on Bottomley's 'doubtful, unknown and insufficiently described' species of *Lycoperdon*. J.C. COETZEE and A.E. VAN WYK 172

Oxalidaceae. Rediscovery and phylogenetic position of the rare *Oxalis purpurata*. K.C. OBERLANDER, L. L. DREYER and F. ROETS 177

Poaceae. Two new species of *Helictotrichon* (Pooidae: Aveneae) from South Africa. A.C. MASHAU, L. FISH and A.E. VAN WYK 179

Poaceae. The correct author citation of *Helictotrichon* (Pooidae: Aveneae). A.C. MASHAU, L. FISH and A.E. VAN WYK 184

Poaceae. A new species of *Pentameris* from Jonaskop, South Africa. H.P. LINDER 190

Rubiaceae. A new species of *Didymosalpinx* and a new species of *Oxyanthus* from Mozambique and Tanzania. J.E. BURROWS and S.M. BURROWS 200

Vitaceae. The status of *Cyphostemma unguiformifolium* in southern Africa. E. RETIEF and N.R. CROUCH 167

5. Checklist of ferns and seed plants of the Golden Gate Highlands National Park, South Africa. M.E. DAEMANE, B-E. VAN WYK and A. MOTEETEE 205

6. How homogeneous is West Coast Renosterveld? Implications for conservation. I.P. NEWTON and R.S. KNIGHT 219

7. Obituary: Michael John Wells (1935–2010). O.A. LEISTNER 227

8. South African National Biodiversity Institute: publications 1 January 2009 to 31 December 2009. Compiler: B.A. MOMBERG 233

9. Guide for authors to *Bothalia* 239

New name and species in *Bothalia* 40,2 (2010)

Berkheya chrysanthemoides *J.C.Manning & Goldblatt*, sp. nov., 185
Bulbinella calcicola *J.C.Manning & Goldblatt*, sp. nov., 197
Colchicum albofenestratum *J.C.Manning & Snijman*, sp. nov., 175
Didymosalpinx callianthus *J.E.Burrows & S.M.Burrows*, sp. nov., 201
Euphorbia neochamaeclada *Bruyns*, nom. nov., 178
Geosiris albiflora *Goldblatt & J.C.Manning*, sp. nov., 170
Helictotrichon rogerellisii *Mashau, L.Fish & A.E.van Wyk*, sp. nov., 179
Helictotrichon roggeveldense *Mashau, L.Fish & A.E.van Wyk*, sp. nov., 179
Heterorhachis hystrix *J.C.Manning & P.O.Karis*, sp. nov., 188
Moraea intermedia *Goldblatt & J.C.Manning*, sp. nov., 147
Moraea vuvuzela *Goldblatt & J.C.Manning*, sp. nov., 148
Nemesia fourcadei *K.E.Steiner*, sp. nov., 161
Nemesia elata *K.E.Steiner*, sp. nov., 164
Oxyanthus biflorus *J.E.Burrows & S.M.Burrows*, sp. nov., 202
Pentameris ellisii *H.P.Linder*, sp. nov., 191
Senecio comptonii *J.C.Manning & Goldbatt*, sp. nov., 193
Senecio esterhuyseniae *J.C.Manning & Goldblatt*, sp. nov., 195

Bothalia 40,2: 147–153 (2010)

Moraea intermedia and *M. vuvuzela* (Iridaceae–Iridoideae), two new species from western South Africa, and some nomenclatural changes and range extensions in the genus

P. GOLDBLATT* and J.C. MANNING**

Keywords: Iridaceae, Iridoideae, *Moraea* Mill., new species, southern Africa, taxonomy

ABSTRACT

We describe two new species in the largely sub-Saharan genus *Moraea* Mill. (± 205 spp.) from its centre of diversity in the winter rainfall region of southern Africa. *Moraea* **intermedia**, from north-central Namaqualand near Springbok, is a member of the small section *Tubiflorae* (now eight species), remarkable in its growth habit with a long basal internode, leaves clustered at the first aerial node, and *Moraea*-type stamens and style branches but subequal tepals with very short claws that clasp only the base of the filament column. *Moraea* **vuvuzela**, a member of series *Galaxia* of the *Galaxia* group of the genus (now 17 species), has deeply fringed stigma lobes, filaments free in the upper 1 mm, ± prostrate, lanceolate leaves and, remarkable for the series, dark brown to purple markings near the base of the tepal limbs. In the unusually variable *M. fugax*, currently with two subspecies, new collections of subsp. *fugax* co-occurring but on different soils with subsp. *filicaulis*, cast doubt on their current treatment as members of the same species. We now favour recognition of the diminutive subsp. *filicaulis* as a separate species, *M. filicaulis*. In the *M. tripetala* group we recommend recognition of the early blooming *M. punctata*, described in 1892 and later subsumed in *M. tripetala* but readily distinguished by the long inner tepals broader in the midline and short, relatively broad, plane rather than channelled leaves. We also report small but significant range extensions for *M. barkerae*, *M. macrocarpa* and *M. tricolor*.

INTRODUCTION

The largely sub-Saharan genus *Moraea* Mill. (Iridaceae: Iridoideae) now comprises ± 205 species of cormous geophytes (Goldblatt & Manning 2009) but new species continue to be discovered. Although florally diverse, *Moraea* is recognized in Iridoideae by a bifacial and channelled (rarely terete or plane) leaf blade, and corms of a single internode derived from a lateral bud. Most species have *Iris*-like flowers with flattened, petaloid style branches to which the stamens are appressed. The occurrence of a variety of other floral types makes exact floral definition of the genus impossible, but most *Moraea* species have free tepals and the filaments partially to completely united. One notable exception is the acaulescent *Galaxia* group of the genus, in which all 17 species have the tepals basally connate to form a closed perigonal tube with the filaments inserted at the base of the tepal segments. One of the two new species named here, *M. vuvuzela*, belongs to this group. The other, *M. intermedia*, is a member of the small section *Tubiflora* Goldblatt, an alliance now including eight species, all sharing distinctive, brown, woody rather than fibrous corm tunics, a yellow, fugaceous perianth, often with brown veins, and acute to obtuse or truncate rather than attenuate inflorescence spathes.

Field work in the southwestern Cape and western Karoo in the past several years has also made us aware that two variable species complexes, *Moraea fugax* D.Delaroche and *M. tripetala* (L.f.) Ker Gawl., both comprise more than a single species. This investigation is continuing but we are now convinced that *M. fugax* subsp. *filicaulis* (Baker) Goldblatt merits species rank, as does *M. punctata* Baker (1904), which was previously subsumed by Goldblatt (1976b) in *M. tripetala* but is lacking one of the defining features of that species, namely reduced inner tepals, either filiform or reduced to minute cusps, and instead has linear inner tepals that are broader and sometimes lobed in the middle.

1. **Moraea intermedia** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 150–450 mm altae, cormo globoso-ovoideo 12–15 mm diam. asymmetrico, tunicis brunneis stratis interioribus intactis exterioribus fibrescentibus, foliis 2 vel 3 supra terram insertis in nodo primo congestis linearibus canaliculatis arcuatis vel trahentibus, caule suberecto ramis congestis ad nodum primum, spathis rhipidialibus viridibus spatha interiore 38–45 mm longa exteriore ± dimido longiore, floribus pallide flavis atrovenosis, tepalis liberis 27–30 mm longis unguibus angustis ± 4 mm longis erectis cupulam angustam formantibus limbis patentibus 23–26 × 9–12 mm, filamentis 8–10 mm longis in columnam glabram connatis, antheris ± 8 mm longis atropurpureis, ovario ± 8 mm longo exserto, ramis styli 6 × 2 mm.

TYPE.—Northern Cape, 2917 (Springbok): Farm Ghoop (Modderfontein), west of Springbok, granitic gravel slope, (–DB), 18 September 2009, *Goldblatt, Manning & Porter 13405* (NBG, holo; K, MO, PRE, iso.).

Plants 150–450 mm high. *Corm* globose-ovoid, 12–15 mm diam., asymmetric with a fibrous downward extension on one side; tunics brown, inner layers unbroken, outer layers of vertical sections held together by cross fibres, sometimes becoming ± fibrous with age. *Stem* ± erect, firm, with a long basal internode, branch-

---

* B.A. Krukoff Curator of African Botany, Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166, USA. E-mail: peter.goldblatt@mobot.org.
** Compton Herbarium, South African National Biodiversity Institute, Private Bag X7, 7735 Claremont, Cape Town. E-mail: j.manning@sanbi.org.za.
MS. received: 2010-02-09.

ing above first aerial node 80–150 mm above ground, first branch inserted in leaf axil, main stem sometimes branched, axes each bearing a single rhipidium. *Leaves* 2 or 3, inserted well above ground and clustered at first aerial node, linear, channelled, lowermost longest, arching to trailing, up to 400 mm long, remaining leaves shorter. *Rhipidial spathes* green, apices acute to ± truncate, turning brown with age, inner 38–45 mm long, outer ± half as long, completely sheathing inner. *Flowers* pale dull yellow with darker veins, nectar guide at base of tepal limbs bright yellow with a brownish outline distally and dark green spots near base; tepals free, 27–30 mm long, claws narrow, ± 4 mm long, erect, together forming a narrow cup around base of filaments, limbs spreading horizontally, 23–26 × 9–12 mm, slightly undulate, inner smaller than outer, widest in distal third, 8–9 mm at widest. *Filaments* 8–10 mm long, united in a smooth, cylindric column; anthers ± 8 mm long, apressed to style branches, overtopping stigma lobe, dark purple; pollen red. *Ovary* ± 8 mm long, fully exserted; style dividing at apex of filament column, branches ± 6 × 2 mm, narrowly diverging, with terminal, transverse, semicircular stigma lobes ± 3 mm wide, dividing above stigma lobe into paired, erect crests 10–12 mm long. *Capsules* and *seeds* unknown. *Chromosome number* unknown. *Flowering time*: mid-September to mid-October. Figure 1.

Distribution and habitat: restricted to the granite hill country of northcentral Namaqualand, west of Springbok, *Moraea intermedia* grows in open places in sandy, granitic ground (Figure 2). At the type and only known locality, the Farm Ghoop west of Springbok, *M. intermedia* is sympatric with the closely related *M. margaretae* Goldblatt, which favours somewhat wetter sites near a small stream. Photographs shown to us by Alta Chambers, who discovered *M. intermedia*, indicate the existence of hybrids between the two species. The flowers of *M. intermedia* open soon after sunrise at ± 7:00 and fade in the afternoon at ± 15:30–16:00. Flowers of *M. margaretae* at this locality have inner tepals with a small brown dot at the limb bases, unusual not only for the species but for the entire genus (*Goldblatt, Manning & Porter 13406A* (MO, NBG).

Diagnosis and relationships: clearly a member of section *Tubiflorae* Goldblatt of the genus (Goldblatt 1976a), *Moraea intermedia* has the brown corm tunics, relatively blunt rhipidial spathes and darkly veined tepals characteristic of the alliance. Vegetatively, the long basal internode with leaves clustered at the first aerial node recalls *M. nana* (L.Bolus) Goldblatt & J.C.Manning of the section but the flowers have typical *Moraea*-like style branches with a terminal, transverse stigma lobe and divided above the stigma into prominent, paired style crests. Unlike the typical *Moraea* flower, however, all six tepals of *M. intermedia* have short claws clasping the base of the filament column, the claws all bearing basal nectaries, and the spreading limbs each have nectar guides at their bases. Other *Moraea*-type flowers have inner tepals lacking both nectaries and nectar guides. The similarly marked inner and outer tepals recall the *Homeria*-type flower of the genus, thus the flowers of *M. intermedia* are in a sense intermediate between those of a typical *Moraea* and species of the *Homeria* group of *Moraea* (Goldblatt 1986c, 1998). Both types of flower occur in section *Tubiflorae*: *M. maximiliani* (Schltr.) Goldblatt and *M. umbellata* Thunb. have *Homeria*-type flowers, whereas *M. cooperi* Baker, *M. linderi* Goldblatt, *M. longiflora* Ker Gawl. and *M. margaretae* Goldblatt, have *Moraea*-type flowers. The two species *M. cooperi* and *M. longiflora* have a perianth tube, unusual in the genus. The remaining member of the alliance, *M. nana*, has *Homeria*-type flowers except that the style branches are reduced to paired filiform arms extending between the anthers, thus recalling the flower of the *Hexaglottis* group of *Moraea*.

Etymology: the epithet *intermedia* alludes to the flowers, which are intermediate between those of a typical *Moraea* and species of the *Homeria* group of *Moraea*, having the petaloid style crests of the former and the subsimilar perianth whorls of the latter.

2. **Moraea vuvuzela** *Goldblatt & J.C.Manning*, sp. nov.

Plantae 15–45 mm altae, cormo subgloboso 12–15 mm diam. asymmetrico, tunicis e strato fibrorum tenuium stratoque duro costis verticalibus prominentibus, alternanti constantibus, foliis ± prostratis anguste lanceolatis ad lineari-lanceolatis 20–35 × 3–4 mm, non profunde canaliculatis marginibus hyalinis, floribus 2–4, hypocrateriformibus pallide flavis in medio brunneis ad purpureis notatis, tubo perianthii cylindrico 8–10 × 1 mm, tepalis infra suberectis cupulam 7–10 mm altam formantibus, supra patulis, obovatis 20–25 × 7–10 mm, filamentis ± 7 mm longis infra connatis in supero 1 mm liberis, antheris 2.0–2.5 mm longis flavis, stylo erecto apices antherarum per 1.5–2.0 mm excedenti, lobis stigmaticis profunde fimbriatis horizontaliter extensis.

TYPE.—Western Cape, 3319 (Worcester): Rawsonville, hills between Breede River and Brandvlei Dam, burnt clay slope, (–CB), 21 July 2009, *A. le Roux & Manning 591* (NBG, holo.; K, MO, PRE, iso.).

Plants ± acaulescent or with stem exserted to 10 mm above soil surface, forming small tufts up to 40 mm high, sheathed by membranous, persistent cataphylls, accumulating below ground to form fibrous collar. *Corm* subglobose, asymmetric below, 10–15 mm diam.; tunics of alternating finely fibrous layer and hard, cartilaginous layer with vertical, claw-like ribs, accumulating with age. *Leaves* not clearly distinguished from floral bracts, lowermost inserted well below ground shortly above corm, short and inconspicuous, two other leaves not associated with a flower, inserted at ground level, bases partly enclosing inflorescence, blades ± prostrate, narrowly lanceolate to linear-lanceolate, 20–35 × 3–4 mm, shallowly channelled; margins hyaline, smooth or minutely cilio-serrulate; remaining leaves each associated with a flower, smaller, falcate, channelled. *Inflorescence* a cluster of 2–4 flowers, each subtended by a leaf and a shorter, sheathing bract; floral bracts 10–15 mm long, pale and membranous in lower half with closed sheath, green above, obscurely bicarinate. *Flowers* salver-shaped, pale yellow marked with median brown or purplish chevron or semi-lunate markings at top of darker yellow cup; perianth tube cylindric, 8–10(–15) × 1 mm, closed at apex, exserted 6–8 mm; tepals suberect

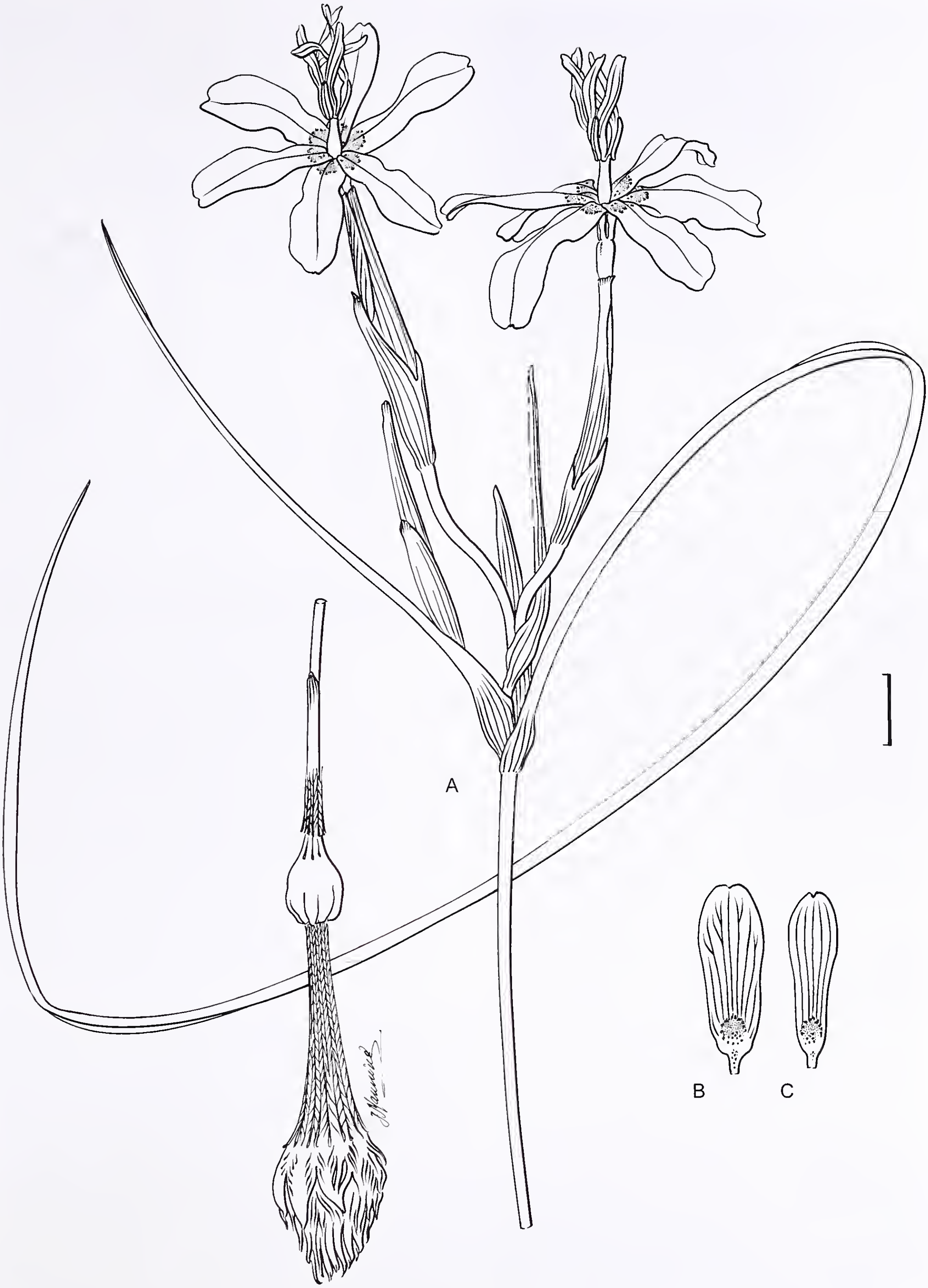


FIGURE 1.—*Moraea intermedia*, *Goldblatt, Manning & Porter 13405* (NBG). A, plant; B, outer tepal; C, inner tepal, Scale bar: 10 mm. Artist: John Manning.

below to form cup 7–10 mm deep, spreading above, obovate, 20–25 × 7–10 mm. *Filaments* united to form a baluster-shaped column, free in upper ± 1 mm, erect but diverging apically, ± 7 mm long, yellow; anthers 2.0–2.5

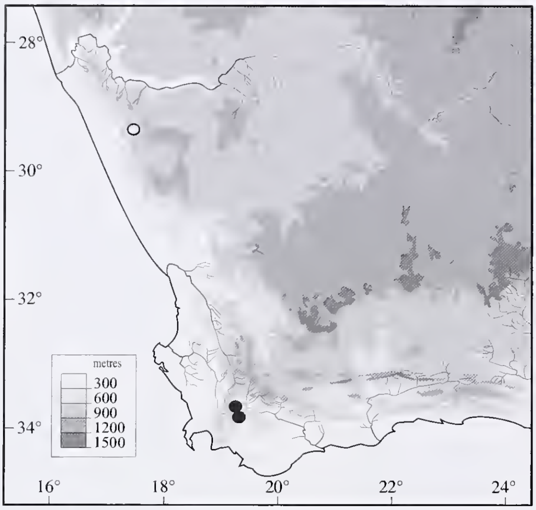


FIGURE 2.—Known distribution of *Moraea intermedia*, ○; and *M. vuvuzela*, ●.

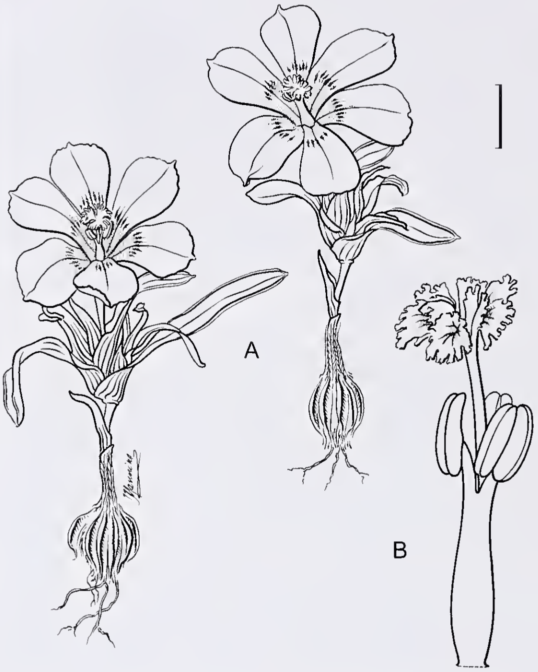


FIGURE 3.—*Moraea vuvuzela, A. le Roux & Manning 591* (NBG). A, plants; B, androecium and style. Scale bar: A, 10 mm; B, 2 mm. Artist: John Manning.

mm long, yellow with yellow pollen. *Ovary* ellipsoid, ± 4 × 2 mm; style erect, reaching 1.5–2.0 mm beyond anther apices, dividing into three deeply fringed lobes spreading horizontally above anthers. *Capsules* and *seeds* unknown. *Flowering time*: late July to September, rarely to early October. Figure 3.

Distribution and ecology: *Moraea vuvuzela* is known from a handful of sites between Rawsonville and Villiersdorp (Figure 2), where it occurs in loamy clay soils in renosterveld shrubland, typically on cooler south- or southeast-trending slopes. Flowering in *M. vuvuzela*, as in many other geophytes, is stimulated by removal of the surrounding shrubs as occurs after a summer fire but it is not an obligate pyrophyte.

The species was brought to our attention by Rawsonville resident and conservationist Anso le Roux, who encountered scattered flowering plants of an unknown *Moraea* of the *Galaxia* group in unburned veld near Rawsonville in August 2006 but it was only after a controlled burn in February 2009 that the species appeared in flower in any number. In July of that year she alerted us to the appearance of hundreds of flowering individuals and we were then able to gather material for description and illustration. Shortly thereafter, conservationist Rupert Koopman and members of the Custodians of Rare and Endangered Wildflowers (CREW) located a second flowering population of the species near Villiersdorp. We have subsequently associated the species with at least two of the collections assigned to the insufficiently known *Galaxia* sp. 1 discussed by Goldblatt (1979) in his revision of the group. Here, he reported the existence of three collections of an unidentified species, two with pale yellow flowers with a dark dot at the base of the tepals from Franschhoek Forest Reserve, and a third from Berg River Hoek. Colour notes from the latter merely mention that the flowers are yellow. Unfortunately details of the style branches were obscured, preventing description of the species. We have examined these collections and are confident that those from Franschhoek Forest Reserve represent earlier gatherings of *M. vuvuzela*, which they match perfectly in the unusual perianth colour and patterning, and in the thickened, woody longitudinal ribs on the corm tunics. Careful examination of the style branches in *Salter 6891* (BOL) confirms that they are spreading and fringed, and that the filaments are free in the distal 1 mm, as in *M. vuvuzela*. The relatively short perianth tube, 10–15 mm, is also consistent with the species. The Theewaterskloof Dam has now inundated extensive, potentially suitable renosterveld habitat in which the species might have occurred. The third collection, from Berg River Hoek, has more fibrous corm tunics and evidently unmarked flowers and we exclude it from the species for the moment.

Diagnosis and relationships: *Moraea vuvuzela* has the spreading, ± fringed stigmatic lobes of series *Galaxia* (Goldblatt 1998), all of which have yellow flowers (Goldblatt 1979). It stands out in the series (and the section) in its pale yellow flowers with brown or purplish markings at the top of the darker yellow floral cup. The remaining members of the series have uniformly bright yellow flowers, except the Cedarberg–Gifberg endemic, *M. luteo-alba* (Goldblatt) Goldblatt, which has pale yellow tepals fading to cream or white distally but filaments united only in the lower third.

Vegetatively, *Moraea vuvuzela* is characterized by its linear-lanceolate, smooth or minutely cilio-serrulate leaves and ± woody corm tunics with prominent, thickened longitudinal ribs only partially separated from one another by transverse fibres. The corm tunics in most other species are less woody, with the longitudinal ribs separated by transverse fibres, with the exception of *M.*

angulata Goldblatt (= *Galaxia alata* Goldblatt), a rare species of seasonally wet flats along the west coast of Western Cape. That species has unique, woody or corky tunics with wing-like longitudinal ribs, distally terete leaves, and uniformly bright yellow flowers with the filaments completely united.

Etymology: the epithet *vuvuzela* derives from the air horn, approximately one metre in length, that is commonly blown by fans at soccer matches in South Africa, and commemorates the country's hosting of the first Soccer World Cup on the African continent in June 2010. The colourful, flared flowers and their massed, synchronous anthesis are appropriate associations with the name. *Moraea vuvuzela* is severely threatened by agriculture, and this dedication is linked to a conservation programme initiated by the non-profit association BIOPAT-Patrons for Biodiversity (www.biopat.de), and sponsored by the Deutsche Gesellschaft für Technische Zusammenarnbeit (GTZ), the German Technical Development Cooperation Agency, which supported the South African Government in the preparations for the FIFA World Cup 2010 on behalf of the German Government.

Additional specimens

WESTERN CAPE.—3319 (Worcester): near Villiersdorp, Hentie De Wet's Farm, sandstone fynbos, (–CD), 16 August 2009, *Koopman CR3890* (NBG). 3419 (Caledon): Franschhoek Forest Reserve, near Bushman's Castle, (–AA), rather pale yellow with small dark spot near base of perianth segment, 30 August 1937, *Salter 6891* (BOL, SAM); 3 October 1942, *Isaac s.n.* (BOL).

CHANGES IN RANK

1. The *Moraea fugax* complex

One of the most widespread of the winter rainfall species of the genus, *Moraea fugax*, as circumscribed by Goldblatt (1986a, b), extends from the Cape Peninsula north to the Richtersveld and east to Swellendam. It has not been recorded in the Karoo Mountain (KM) or Southeast (SE) centres of the Cape Floristic Region, but does occur locally in the western Karoo as well as widely across Namaqualand. The species, or complex, is distinguished by the long basal internode with the solitary or two leaves inserted at the first aerial node, two or more short branches, flowers with the ovary included in the spathes, and capsules with a short, sterile beak. As noted by Goldblatt, *M. fugax* is strikingly variable. The taller subsp. *fugax* has large or medium-sized white to blue flowers and two foliage leaves, whereas the slightly shorter, yellow-flowered plants (the type form) usually have a single leaf and flowers with broader tepals. In contrast, subsp. *filicaulis*, a much smaller plant, has small flowers and two, subequal or unequal, narrow to almost filiform leaves. Cytologically the complex is remarkably variable (Goldblatt 1986b). Tall plants with blue or white flowers have a diploid number of $2n = 20$, 18, 16 or rarely 14; yellow-flowered plants mostly have $2n = 10$, occasionally 16 or 14; and subsp. *filicaulis* has $2n = 12$ or 10 (with one doubtful record of 18). Goldblatt (1986b) postulated that dysploid decrease in chromosome number has occurred in all three lineages and that a basic chromosome number of $x = 10$ is ancestral for the complex and that base is shared with *M. gracilenta* Goldblatt and *M. macrocarpa* Goldblatt, remaining members of the *M. fugax* alliance.

The ranges of the two larger-flowered morphs (white to blue or yellow perianth) overlap along the Western Cape Atlantic coast, but we have noted that the white- or blue-flowered morph favours deep, coarse sands and granitic slopes and is more common along the coast in sandveld, although plants also occur in strandveld and in fynbos; yellow-flowered plants favour rocky habitats usually in hard, stony sand and typically occur in fynbos. Subsp. *filicaulis* most often grows in hard sandy ground (*hardeveld*) as well on rocky granitic gravel of the Namaqualand hill country and on the west coast of Western Cape in sandy limestone or calcrete. New collections of the two subspecies suggest that the habitat distinctions are significant. For example, we have found subsp. *filicaulis* growing adjacent to tall, white-flowered subsp. *fugax* in Namaqualand (e.g. *Goldblatt & Porter 13310*, *13311* MO, NBG), one in hard, compact sand and the other immediately adjacent on deeper sands of stabilized dunes. Likewise, plants matching subsp. *filicaulis* are common in the Saldanha Bay area on limestone or lime enriched sands (e.g. *Goldblatt & Porter 13258* MO, NBG) and grow within a few metres of the large blue- or white-flowered morphs of the common subsp. *fugax* that grow on deeper sands. Separation at subspecies rank of these plants that are morphologically, ecologically and cytologically distinct seems to inadequately reflect biological reality, and treatment as separate species seems appropriate.

We note here that this revision to the taxonomy of the complex does not fully reflect its morphological variation: flower colour and markings and leaf dimensions in *Moraea filicaulis*, and *M. fugax* may, when studied in more detail, require further refinement, for both are variable for these features. The nomenclature and synonymy of *M. filicaulis* is presented below. A full description of the species, as *M. fugax* subsp. *filicaulis*, is presented in Goldblatt's (1986b) account of the *M. fugax* species group.

Moraea filicaulis *Baker* in Bulletin de l'Herbier Boissier, sér. 2: 1005 (1904). *M. fugax* subsp. *filicaulis* (Baker) Goldblatt: 155 (1986b). Type: South Africa, [Northern Cape], Kamiesberg between Roodeberg and Ezelskop, *Drège 2605* (K, lecto.!, designated by Goldblatt 1976b: 725; MO!, P!, iso.).

M. diphylla Baker: 42 (1906). Type: South Africa, [Western Cape], Olifants River, *Penther 734* (K, lecto.!, designated by Goldblatt 1976b: 725).

2. The *Moraea tripetala* complex and *M. punctata*

As treated by Goldblatt (1976b, 1986a), *Moraea tripetala* was a variable complex of mostly blue- to purple-flowered species with a single foliage leaf, inner tepals much reduced and usually cusp-like, and filaments free or basally united for up to 2 mm. Typical *M. tripetala*, from the Cape Peninsula and nearby, has a narrowly channelled leaf but plants from the western Karoo and mountains surrounding the mid-Olifants River Valley have leaf blades ± flat distally, as does an early flowering series of populations from the Western Cape coastal forelands. These latter plants have, in addition, unusually long inner tepals for the species, up to 15 mm long and expanded in the middle, sometimes into distinct lobes. The leaves are also relatively short, rarely exceeding the short stem, itself usually less than 200 mm long (rarely up to 250 mm). Plants with these characeristics have twice been accorded species rank, as *M. punctata* Baker (1904) and *M. monophylla* Baker (1906), but were both included in a broadly circumscribed *M. tripetala* by Goldblatt (1976b, 1986a). It has become clear to us that a more narrowly drawn *M. tripetala* would be more useful as several recognizable morphs have overlapping ranges, flower at the same time or at different times, and sometimes have different habitat preferences. *M. punctata* is the most obvious of these and we recommend its recognition as a separate species. The nomenclature and a brief description are provided below.

Moraea punctata *Baker* in Bulletin de l'Herbier Boissier, sér. 2, 4: 1003 (1904). Type: South Africa, [Western Cape], Piketberg Road [Gouda], 17 August 1897, *Schlechter 4851* (K, lecto.!, designated by Goldblatt 1976: 751; B!, GRA!, PRE!, iso.).

M. monophylla Baker: 24 (1906). Type: [Western Cape], Clanwilliam, Olifants River, August 1894, *Penther 685* (K, lecto.!, designated by Goldblatt 1976: 751).

Plants 150–250 mm high; stem simple, rarely 1-branched (1 plant of 16 seen), smooth on vegetative parts, rarely pilose (1 plant seen), sheathed below by brown, fibrous cataphylls, these often accumulating. *Corms* mostly 10–15 mm diam., evidently without cormlets at base; tunics of medium to coarse fibres, vertical fibres usually thickened into prominent claws below. *Foliage leaf* solitary, linear, shallowly channelled below, flat and slightly twisted in distal third, ± as long as stem, 3–5 mm wide, smooth (rarely pilose abaxially); cauline sheathing leaves 20–40 mm long. *Rhipidial spathes* smooth, inner 35–40(–45) mm long, outer ± half as long. *Flowers* pale blue or white, nectar guides triangular, white with dark blue dots and edged in darker colour, velvety (or smooth); outer tepal limbs obovate, widest in distal third, 14–15 × ± 10 mm, plane, margins curling under later, held at 45°, claws narrow, 9–12 mm long, inner tepals ± linear to ± tricuspidate, obtuse, 7.5–12.5 mm long. *Filaments* 3.0–3.5 mm long, united for 0.5–1.5 mm; anthers 4.5–6.5(–7.5) mm long; pollen colour unknown. *Ovary* narrowly ovoid, 7–8 mm long; style 1–2 mm long, style branches 7–9 mm long, crests linear, 8–10 mm long. *Capsules and seeds* unknown. *Flowering time*: mid-August to mid-September, rarely later.

Distribution and habitat: evidently a species of renosterveld vegetation, *Moraea punctata* is centred in the Western Cape lowlands between Dassenberg (near Mamre) and Piketberg, extending inland locally to Tulbagh. A record said to be from the Olifants River Valley at or near Clanwilliam (*Penther 685,* the type of *M. monophylla*) is almost certainly a mistake and was more likely made en route from Porterville to Clanwilliam. Soils on which *M. punctata* grows are described as shale, consistent with renosterveld and we have seen plants on loamy clay.

Diagnosis: as already outlined, *Moraea punctata* has some of the critical features of the *M. tripetala* group, notably a blue (rarely white) perianth and filaments united for less than 2 mm, but the inner tepals are linear and expanded to obtusely lobed in the middle and spreading distally instead of being reduced to erect, filiform, acute cusps. Unlike the southwestern Cape populations of *M. tripetala*, which have narrowly channelled leaves longer than the stems, *M. punctata* has relatively short leaves, 3–5 mm wide, plane in the distal half, and about as long as the stems. As in *M. tripetala*, leaves are occasionally pilose on the abaxial surface, a character that appears to have no taxonomic significance.

Representative specimens

WESTERN CAPE.—3218 (Clanwilliam): flats north of Piketberg at Eendekuil turnoff, renosterveld, (–DB), 1 September 1981, *Goldblatt 6127* (MO, NBG). 3318 (Cape Town): Dassenberg north of Mamre, west slopes, (–AD), 23 September 1974, *Nordenstam & Lundgren 1998* (MO, S); near Moorreesburg, Klein Swartfontein, renosterveld on shale, (–BA), 25 August 1970, *Acocks 24320* (MO); near Wellington, (–DB), 15 August 1926, *Grant 2361* (MO). 3319 (Worcester): flats south of Tulbagh Road station, (–AC), 11 August 1974, *Goldblatt 2310* (MO).

RANGE EXTENSIONS

1. *Moraea barkerae* Goldblatt

This relatively rare Western Cape species of the Cedarberg and northern Cold Bokkeveld Mountains (Goldblatt 1986a) was recorded in October 2008 at the northern end of the Piketberg Range (I. Ebrahim pers. comm.). Plants flowering there after a fire resemble the Cedarberg populations closely in the pale pink perianth, violet nectar guides on the outer tepal limbs and a particularly long tepal claw exceeding the limb. The species remains endemic to the Northwest Centre of the Cape Floristic Region (Goldblatt & Manning 2000).

Specimen seen

WESTERN CAPE.—3218 (Clanwilliam): Piketberg, Farm Wagenpad, (–DA), 30 October 2008, *Ebrahim s.n.* (NBG, photograph only).

2. *Moraea macrocarpa* Goldblatt

Described from the Piketberg District (Goldblatt 1986b), the species is closely allied to the *Moraea fugax* group but the one or two basal leaves subtending the rhipidia are inserted on the stem at or close to ground level. Plants have, for their small size, a relatively long ovary and capsule, the latter 18–25 mm long. *M. macrocarpa* is currently known from the Piketberg and the Olifants River Valley and adjacent mountains, where it is common and fairly well represented in herbaria. Recently, we have recorded the species at the Farm Avontuur in the Bokkeveld Mountains, northwest of Nieuwoudtville, and well to the south in the Saldanha–Langebaan area of the Western Cape coast. This latter collection represents the first record for the Southwest Centre of the Cape Floristic Region.

Specimens seen

NORTHERN CAPE.—3119 (Calvinia): Bokkeveld Mountains, Farm Avontuur, NW of Nieuwoudtville, (–AC), 28 August 2008, *Goldblatt & Manning 13052* (NBG).

WESTERN CAPE.—3318 (Cape Town): sandy flats between Langebaan and Saldanha, (–AA), 8 September 2009, *Goldblatt & Porter 13287* (NBG).

3. *Moraea tricolor* Andrews

In 2009 we reported range extensions of this member of the *Moraea ciliata* group from its centre in the Malmesbury–Tulbagh Districts of Western Cape eastward to Still Bay and north to Langebaan near Saldanha (Goldblatt & Manning 2009). The species was subsequently photographed by ecologist Greg Nicolson during his survey of the road reserve along the N7 at the foot of Piekenierskloof Pass, thus extending the known range some 80 km north of Gouda, the nearest recorded population. The Piekenierskloof plants have pale yellow flowers with darker yellow nectar guides, whereas the Gouda populations have pink to red flowers with yellow nectar guides outlined in darker pink or red.

Specimen seen

WESTERN CAPE.—3218 (Clanwilliam): foot of Piekenierskloof Pass, (–DB), 29 June 2007, *Nicolson s.n.* (NBG, photograph only).

ACKNOWLEDGEMENTS

We thank Anso le Roux and Alta Chambers for bringing the two new species to our attention, and Elizabeth Parker and Len Porter for assistance in the field. Field work was supported in part by grant 8248-07 from the US National Geographic Society.

REFERENCES

BAKER, J.G. 1904. Iridaceae. In H. Schinz, Beiträge zur kenntnis der Afrikanischen-Flora XVI. *Bulletin de l'Herbier Boissier,* sér. 2, 4: 1003–1007.

BAKER, J.G. 1906. II.—Diagnoses africanae, XVI. *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew* 1906: 15–30.

GOLDBLATT, P. 1976a. Evolution, cytology and subgeneric classification in *Moraea* (Iridaceae). *Annals of the Missouri Botanical Garden* 63: 1–23.

GOLDBLATT, P. 1976b. The genus *Moraea* in the winter rainfall region of southern Africa. *Annals of the Missouri Botanical Garden* 63: 657–786.

GOLDBLATT, P. 1979. Biology and systematics of *Galaxia* (Iridaceae). *Journal of South African Botany* 45: 385–423.

GOLDBLATT, P. 1986a. The moraeas of southern Africa. *Annals of Kirstenbosch Botanical Garden* 14: 1–224.

GOLDBLATT, P. 1986b. Cytology and systematics of the *Moraea fugax* complex (Iridaceae). *Annals of the Missouri Botanical Garden* 73: 140–157.

GOLDBLATT, P. 1986c. Convergent evolution of the *Homeria* flower type in six new species of *Moraea* (Iridaceae) in southern Africa. *Annals of the Missouri Botanical Garden* 73: 102–116.

GOLDBLATT, P. 1998. Reduction of *Barnardiella, Galaxia, Gynandriris, Hexaglottis, Homeria* and *Roggeveldia* in *Moraea* (Iridaceae: Irideae). *Novon* 8: 371–377.

GOLDBLATT, P. & MANNING, J.C. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9. National Botanical Institute, Cape Town and Missouri Botanical Garden, St Loius.

GOLDBLATT, P. & MANNING, J.C. 2009. New species of *Moraea* (Iridaceae: Iridoideae), with range extensions and miscellaneous notes for southern African species. *Bothalia* 39: 1–10.

Bothalia 40,2: 155–159 (2010)

Taxonomic notes on the Clathraceae (Phallales: Phallomycetidae) *sensu* Bottomley and a new key to the species in southern Africa

J.C. COETZEE*

Keywords: Clathraceae, Gasteromycetes, nomenclature, Phallales, Phallomycetidae, southern Africa, taxonomy

ABSTRACT

Bottomley's (1948) *Gasteromycetes of South Africa* is still widely used for identification purposes. However, as a result of developments since 1948, the work has become outdated in many respects. Entries in the Clathraceae are here updated and briefly commented upon and a species key to the twelve southern African representatives of the family is provided.

INTRODUCTION

The classic work on the Gasteromycetes of South Africa by Bottomley (1948), still widely used as a definitive reference for the region, is outdated, not only as an identification tool, but also as a measure of the diversity of the southern African gasteromycetous fungi (Coetzee *et al.* 1997). There is a need for an interim aid facilitating the more effective use of Bottomley (1948), and to that purpose a first contribution, dealing with the Geastreae, Tulostomataceae, Nidulariaceae and Sphaerobolaceae *sensu* Bottomley (1948), appeared in this journal some time ago (Coetzee *et al.* 1997). The current paper constitutes the second instalment to be used in conjunction with Bottomley (1948). Although this contribution contains some personal taxonomic judgements, it does not proclaim to be a critical re-appraisal of the family concerned and primarily reflects the views and ideas expressed in the literature since 1948. It is presented also in the hope that it might kindle the necessary interest for further studies on this intriguing but taxonomically poorly understood group of macrofungi in southern Africa.

ANNOTATED LIST OF TAXA

As in Coetzee *et al.* (1997) the order of arrangement of taxon entries below follows Bottomley (1948), and the headings of the taxon names and author citations have been taken, unchanged, from the latter publication. The number in brackets following each heading refers to the relevant page number in Bottomley (1948). Suggested taxon names and/or corrections are supplied in bold. References to ICBN Articles and Recommendations pertain to the Vienna Code (McNeill *et al.* 2006). Author citations are abbreviated according to Brummitt & Powell (1992).

1. Phallales (509)

The order **Phallales** *E.Fisch.* originally included two families, the Phallaceae Corda (stinkhorns) and the Clathraceae Chevall. (cage fungi). Cunningham's (1931) extension of the order to include also the Claustulaceae G.Cunn. has been widely accepted (Bottomley 1948; Zeller 1949; Dring 1973; Jülich 1981; Hawksworth *et al.* 1995; Mills *et al.* 1997; Kirk *et al.* 2001; May *et al.* 2003; Kirk *et al.* 2008) but Dring's (1973) incorporation of the order Hysterangiales into the Phallales, widely accepted initially (Fan *et al.* 1994; Hawksworth *et al.* 1995; Mills *et al.* 1997; Kirk *et al.* 2001), is not considered appropriate anymore (Hosaka *et al.* 2007; Kirk *et al.* 2008).

Several recent authors such as Kasuya (2007), Leite *et al.* (2007) and Cortez *et al.* (2008) have adopted the classification of Kirk *et al.* (2001) who treated the entire gomphoid-phalloid clade—the monophyly of which was proposed by Hibbett & Thorn (2001) and supported by Binder & Hibbett (2002)—as the order Phallales. This lumper's approach forces the elimination of various monophyletic groups, including distinct and well-established families such as the Clathraceae, which then disappears into an expanded Phallaceae (Hosaka *et al.* 2007). The recent proposal by Hosaka *et al.* (2007) to treat the gomphoid-phalloid clade as a subclass (Phallomycetidae *K.Hosaka, Castellano & Spatafora*) comprising the four orders Geastrales *K.Hosaka & Castellano*, Hysterangiales *K.Hosaka & Castellano*, Gomphales *Jülich* and the Phallales, has been favourably received and has already been adopted in the new consensus classification of the kingdom Fungi proposed by the 'Assembling the Fungal Tree of Life' (AFTOL) Project (Hibbett *et al.* 2007) as well as the latest edition of the authoritative *Dictionary of the Fungi* (Kirk *et al.* 2008).

1.1. Clathraceae *Ed. Fischer* (521)

The correct author citation for this family, which was the subject of a revision and monograph by Dring (1980), is **Clathraceae** *Chevall.* Dring's (1980) classification of the family has been adopted almost without question by most subsequent workers, but the more traditional generic delimitations as retained in Miller & Miller (1988), and Pegler & Gomez (1994) might perhaps not be devoid of merit altogether.

Kirk *et al.* (2001) incorporated the Clathraceae into the Phallaceae but in a recent study of the molecular phylogenetics of the gomphoid-phalloid fungi, Hosaka *et al.* (2007) regarded the Clathraceae as a monophyletic group worthy of recognition at family level. Despite

---

* Department of Horticultural Sciences, Cape Peninsula University of Technology, P.O. Box 1906, 7535 Bellville.
E-mail: coetzeej@cput.ac.za.
MS. received: 2009-09-21.

their acceptance of the new classification of the Phallomycetidae as proposed by Hosaka *et al.* (2007), Kirk *et al.* (2008), in the latest edition of the *Dictionary of the Fungi*, did not recognise the Clathraceae as an autonomous family, but incorporated all the clathraceous genera in the Phallaceae. The proposal by Hosaka *et al.* (2007), to treat the Lysuraceae Corda as a segregate family of the Clathraceae *sensu* Dring (1980), has also not found acceptance in Kirk *et al.* (2008).

1.1.1. Linderiella *G.H. Cunningham* (521)

Cunningham (1931) separated the genus *Linderia* G.Cunn. from *Clathrus* but later changed the name to *Linderiella* G.Cunn. because of the confusing similarity between *Linderia* and the earlier *Lindera* Thunb. (Cunningham 1942). Despite the persistent preference of *Linderia* over *Linderiella* by some authors (Dring 1973; Liu 1984; Miller & Miller 1988; May *et al.* 2003), Cunningham's name change was perfectly justified in terms of Example 6 of the current ICBN Art. 53.3 which unambiguously indicates that *Linderia* should be treated as a later homonym of *Lindera*. Dring's (1980) re-incorporation of *Linderiella* into *Clathrus* has found general acceptance (Hawksworth *et al.* 1995; Mora & Garza 1997; Kirk *et al.* 2001; May *et al.* 2003; Calonge *et al.* 2005; Kirk *et al.* 2008) but Miller & Miller (1988) and Pegler & Gomez (1994) preferred to retain *Linderiella* as a separate genus. Should that, for whatever reason, be the correct approach, Dring (1980) is of the opinion that not *Linderiella*, but *Colonnaria* Raff., as proposed by Fischer (1933) and as applied by Santesson (1943), Zeller (1949) and Gómez (1974), would be the correct generic name to use.

1.1.1.1. Linderiella columnata *(Bosc.) G.H. Cunningham* (521)

Bottomley (1948) based this entry on a single record only, namely the type collection of *Laternea angolensis* Welw. & Curr. from Angola which, according to Dring (1980) is neither a *Laternea* Turpin nor a *Linderiella*, but a *Blumenavia* Möller. The correct name and author citation for this species is **Blumenavia angolensis** *(Welw. & Curr.) Dring*. The alleged record from the Drakensberg Mountains of South Africa (Dring 1980) is incorrect. The material in question did not come from the Drakensberg, but from Drachenberg near Amani in the East Usambara Mountains, Tanzania (Eichelbaum 1907).

1.1.2. Anthurus *Kalchbrenner and MacOwan* (522)

Most recent authors have accepted Dring's (1980) relegation of the genus **Anthurus** *Kalchbr. & MacOwan* to synonymy under *Clathrus* (Mornand 1993; Van der Westhuizen & Eicker 1994; Hawksworth *et al.* 1995; Kirk *et al.* 2001; May *et al.* 2003; Tkalčec *et al.* 2005; Kirk *et al.* 2008). Miller & Miller's (1988) and Pegler & Gomez's (1994) preference to retain *Anthurus* as an autonomous genus might not be devoid of merit, however, and a molecular investigation of the *Anthurus-Clathrus* relationship should provide instructive insight in this regard.

1.1.2.1. Anthurus Archeri *(Berkeley) Ed. Fischer* (522)

If treated as a *Clathrus*, the correct name and author citation for this fungus would be **Clathrus archeri** *(Berk.) Dring*. In the genus *Anthurus*, however, the correct name is **Anthurus archeri** *(Berk.) E.Fisch.*

1.1.3. Lysurus *Fries* (523)

A number of authors, including Greuter *et al.* (1993) in NCU3, have used Fr.: Fr. as the author citation for this genus described by Fries (1823). That, however, is the result of a misunderstanding of the sanctioning principle as contained in Articles 13.1 d. and 15 of the current ICBN. Fries's *Systema mycologicum*, volumes 1–3 (1821, 1822, 1823, 1829, 1832), including his *Elenchus fungorum* (1828) are sanctioning works for the 'Fungi caeteri', but not for the 'Gasteromycetes'. Gams (1984) clearly and unambiguously explained the situation as follows: 'names of Gasteromycetes etc. not sanctioned by Persoon but listed by Fries have not been sanctioned' The use of the sanctioning notation is thus inappropriate for this genus and the correct citation would merely be **Lysurus** *Fr.*

According to Hosaka *et al.* (2007), *Lysurus* is more closely allied to the Phallaceae than the Clathraceae and they therefore resurrected the long ignored Lysuraceae *Corda* to accommodate this genus. As already mentioned, this approach has not been adopted in Kirk *et al.* (2008).

1.1.3.1. Lysurus Gardneri *Berkeley* (524)

As indicated also by Dring (1980), the inclusion of *Lysurus gardneri* Berk. in Bottomley (1948) seems to have been based on a misidentification. Plate 22 in Bottomley (1948) clearly does not depict *L. gardneri*, but **Lysurus cruciatus** *(Lepr. & Mont.) Henn.*, of which *Anthurus woodii* MacOwan in Kalchbr. and *Lysurus woodii* (MacOwan) Lloyd from KwaZulu-Natal are synonyms (Dring 1980). Dring's (1980) claim that *L. gardneri* occurs in South Africa requires verification.

1.1.4. Aseroe *La Billardiere ex Fries* (526)

The correct spelling and author citation is **Aseroë** *Labill.* (note the diaeresis). Four species—*Aseroë floriformis* Baseia & Calonge, *A. coccinea* Imazeki & Yoshimi ex T.Kasuya, *A. arachnoidea* E.Fisch. and *A. rubra* Labill.—are currently accepted in the genus (Kasuya 2007), of which only *A. rubra* is known to occur in southern Africa.

1.1.4.1. Aseroe rubra *La Billardiere ex Fries* (526)

Bottomley (1948) regarded the occurrence of this species in South Africa as 'rather doubtful' and speculated that the single record from Cape Town might actually have been based on a misidentified *Clathrus archeri* (as *Anthurus archeri*) specimen at Kew. This suspicion was later corroborated by Demoulin & Dring (1975) and Dring (1980). Subsequent to Bottomley (1948), the occurrence of *Aseroë rubra* in South Africa has, however, been confirmed by various authors (Talbot 1958; Swart 1959; Jacot-Guillarmod 1959; Demoulin & Dring

1975; Dring 1980; Van der Westhuizen & Eicker 1994; Howell 2006; Gryzenhout 2007). *A. rubra* is known also from Swaziland (Demoulin & Dring 1975), but not the Karoo as indicated in Gryzenhout (2007). The collection (*PREM41980*) referred to by Gryzenhout, did not come from Richmond in the Karoo, but from Richmond in KwaZulu-Natal (Jacot-Guillarmod 1959). Due to the change in the starting point for the nomenclature of the non-fossil fungi in 1981 (Korf 1983), the correct author citation for this species is **Aseroë rubra** *Labill.*

1.1.5. Clathrus *Micheli ex Persoon* (527)

In accordance with the changes to the ICBN enacted in 1981 (Korf 1983), the appropriate author citation, indicating also the sanctioned status of this name, should be **Clathrus** *P.Micheli ex L. : Pers.* or merely **Clathrus** *L. : Pers.* as provided for by Article 46.6 of the current ICBN. As explained by Korf (1996), the ': Pers.' notation may also be omitted in non-taxonomic papers.

1.1.5.1. Clathrus cibarius *(Tulasne) Ed. Fischer* (528)

According to Dring (1980) this species should be placed in the genus **Ileodictyon** *Tul.* as **Ileodictyon cibarium** *Tul.* in Raoul (1844).

1.1.5.2. Clathrus gracilis *(Berkeley) Schlechtendal* (529)

According to Dring (1980), this species should be placed in the genus *Ileodictyon* as **Ileodictyon gracile** *Berk.*

1.1.5.3. Clathrus sp. (529)

Although Dring (1980) suggested that the material mentioned in Bottomley (1948) might be akin to *Clathrus crispus* Turpin, it also bears some resemblance to *Clathrus preussii* (Henn.) Henn. While it is safe to say that Bottomley's fungus is not conspecific with either *C. crispus* or *C. preussii*, its true identity remains unresolved and requires further investigation.

1.1.6. Clathrella *Fischer* (530)

Fischer's (1898) separation of **Clathrella** *E.Fisch.* from *Clathrus* does not seem to have found much acceptance and important authors such as Zeller (1949), Dring (1973, 1980), Miller & Miller (1988), Pegler & Gomez (1994), Hawksworth *et al.* (1995) and Kirk *et al.* (2001, 2008) have not accepted *Clathrella* as an autonomous genus.

1.1.6.1. Clathrella Baumii *(P. Henn.) Ed. Fischer* (531)

According to Dring (1980) the correct name and author citation for this fungus is **Clathrus baumii** *Henn.* The type specimen from Angola (Dring 1980) represents the only known record of this species from southern Africa (Bottomley 1948; Dring 1980).

1.1.6.2. Clathrella cfr. pseudocancellata *Ed. Fischer* (531)

Although Dennis in Dring (1980) tentatively accepted Bottomley's (1948) doubtful identification—but as **Clathrus pseudocancellatus** *(E.Fisch.) Lloyd*—this determination is quite uncertain and requires verification.

1.1.7. Kalchbrennera *Berkeley* (532)

Dring's (1980) emendation of the genus *Lysurus* to embrace all the stipitate clathraceous genera, resulting in the relegation of *Kalchbrennera* to synonymy under *Lysurus*, has been widely accepted (Hawksworth *et al.* 1995; Kirk *et al.* 2001; Kirk *et al.* 2008). A few authors, however, have continued to treat **Kalchbrennera** *Berk.* as an autonomous genus (Levin *et al.* 1985; Miller & Miller 1988; Pegler & Gomez 1994).

1.1.7.1. Kalchbrennera corallocephala *(Welwitsch et Currey) Kalchbrenner* (532)

If one accepts Dring's (1980) concept of the genus *Lysurus*, the correct name for this fungus would be **Lysurus corallocephalus** *Welw. & Curr.*, but if treated as a *Kalchbrennera*, the name **Kalchbrennera corallocephala** *(Welw. & Curr.) Kalchbr.* is correct.

REVISED KEY TO SPECIES OF CLATHRACEAE IN SOUTHERN AFRICA

Apart from the species discussed above, the twelve Clathraceae species known to occur in southern Africa also include *Clathrus transvaalensis* Eicker & D.A.Reid (Eicker & Reid 1990; Van der Westhuizen & Eicker 1994) from Gauteng and *Clathrus* cf. *crispus*, not previously reported from the African continent and included here as an unconfirmed first record based on recent photographic evidence only.

Bottomley (1948) provided a key to the genera of the Clathraceae but no species key. A key to species is presented here, based partly on my own observations but relying heavily also on the descriptions in Bottomley (1948), Dring (1980), Eicker & Reid (1990) and Van der Westhuizen & Eicker (1994). A useful glossary of terms is contained in Bottomley (1948).

1a Receptacle with bright red arms radiating sideways in a stellate fashion:
  2a Receptacle stellate with 5–11 apically bifurcating arms arising from a ± horizontally flattened disk at apex of a reasonably prominent stipe; gleba restricted to upper surface of disc and bases of arms, apices of arms devoid of gleba .... 1. *Aseroë rubra* Labill.
  2b Receptacle composed of 4–8 rugulose arms tapering to pointed tips, initially joined apically but separating as receptacle matures, spreading out sideways resembling arms of an octopus; outer surface of arms pale pink, distinctly furrowed longitudinally; gleba occurring along entire lengths of blood-red inner surfaces of arms .... 2. *Clathrus archeri* (Berk.) Dring [= *Anthurus archeri* (Berk.) E.Fisch.]
1b Receptacle not with stellate arms but composed of apically fused columns or hollow latticed structure or stipitate with gleba borne apically on specialized glebiferous structures:
  3a Receptacle not stipitate, composed of 3–5 apically fused white columns, each up to 10 mm wide; gleba restricted to two rows of ragged glebiferous wings extending entire length of inner angles on each side of each column ......3. *Blumenavia angolensis* (Welw. & Curr.) Dring

3b Receptacle distinctly stipitate or consisting of hollow spherical to ovoid latticed (clathrate) structure:

4a Receptacle distinctly stipitate, not divided into separate columns; gleba borne apically on specialized glebiferous structures:

5a Receptacle terminating apically in hollow, dome-shaped, red, latticed structure composed of transversely rugulose arms bearing simple or forked, erect appendages at intersections of arms; gleba occurring on all surfaces of clathroid apical part and appendages .... 4. *Lysurus corallocephalus* Welw. & Curr. [= *Kalchbrennera corallocephala* (Welw. & Curr.) Kalchbr.]

5b Receptacle terminating apically in 4–7 vertical columns, inner, convex surface of each covered by gleba which does not extend to smooth, white, orange or red, concave outer surfaces .... 5. *Lysurus cruciatus* (Lepr. & Mont.) Henn.

4b Receptacle not stipitate but clathrate, consisting of hollow, spherical to ovoid, latticed ball:

6a Receptacle hollow, spherical, latticed structure lacking dorsiventral differentiation, becoming detached from rest of basidiocarp at maturity:

7a Receptacle globose, white, translucent; arms marked with creases due to concertina-like folding in egg, not thickened at intersections; gleba distributed uniformly on insides of arms; odour of camembert cheese .... 6. *Ileodictyon cibarium* Tul.

7b Receptacle globose, white; arms relatively smooth, not creased as in previous species, considerably wider at intersections; gleba covering entire inner surface of arms; odour sweet-sour, not foul .... 7. *Ileodictyon gracile* Berk.

6b Receptacle distinctly clathroid with clearly defined apical and basal parts:

8a Receptacle red or orange:

9a Receptacle bright red; arms large in relation to openings, creating appearance of perforated ball rather than a mesh; openings roundish, not polygonal, surrounded by distinct border (corona) clearly distinguishable from rest of arm; spores 3.8–4.2 × 1.8–2.2 μm .... 8. *Clathrus* cf. *crispus* Turpin

9b Receptacle red; openings between arms not bordered by a corona:

10a Receptacle reddish orange; arms round to rounded triangular, transversely rugulose on outside, more strongly so on the inside, openings polygonal; gleba borne on inner surfaces of arms, mostly on wart-like cushions at intersections; spores 4–5 × 2–4 μm .... 9. *Clathrus* cf. *pseudocancellatus* (E.Fisch.) Lloyd

10b Mature receptacle red at apex, salmon buff at base; outer surface of arms longitudinally grooved, inner surface transversely rugulose, margins expanded into projecting points giving arms a fringed appearance; gleba evenly distributed on inner surface of all but basal arms; spores 3.5–5.1 × 1.6–2.2 μm .... 10. *Clathrus* sp.

8b Receptacle yellow to salmon-coloured, yellowish brown, pale ochraceaous, pinkish brown or white:

11a Receptacle yellow to salmon-coloured, otherwise as described under 10a with spores up to 4 μm wide .... 9. *Clathrus* cf. *pseudocancellatus* (E.Fisch.) Lloyd

11b Spore width not exceeding 2.2 μm:

12a Receptacle white to bright yellow to yellowish brown or pale ochraceous; outer surface of arms distinctively flat, gleba borne on wart-like bulges at arm intersections; odour very foetid; spores 4.0–5.4 × 1.5–2.2 μm .... 11. *Clathrus baumii* Henn.

12b Receptacle consisting of up to eight stout, erect, columns, white to yellowish or cream-coloured below, darkening upwards to pale pinkish brown, supporting a pinkish brown or salmon-coloured clathroid mesh; gleba borne on unique glebiferous organs mostly located at junctions of arms but also elsewhere, consisting of cushion-like swellings with clathroid meshes, apically bearing lobed processes; odour fruity, of granadilla and pineapple; spores 4.0–4.5 × 1.5 μm .... 12. *Clathrus transvaalensis* Eicker & D.A.Reid

Note: *Clathrus crispus* has hitherto been known from the West Indies and the Americas (North, South and Central) only, and confirmation of its occurrence in South Africa would significantly expand its distribution range. South African record:

GAUTENG—2528 (Pretoria): Pretoria, Magalieskruin, in humus-rich soil beneath mango (*Mangifera indica*) tree, 29 January 2009, (–CA), *Hannes van der Merwe s.n.* (*PRUM4484*, photographs only).

ACKNOWLEDGEMENT

Thanks to Prof. A.E. van Wyk, University of Pretoria, for drawing the author's attention to the *Clathrus* collection from Magalieskruin.

REFERENCES

BINDER, M. & HIBBETT, D.S. 2002. Higher-level phylogenetic relationships of Homobasidiomycetes (mushroom-forming fungi) inferred from four rDNA regions. *Molecular Phylogenetics and Evolution* 22: 76–90.

BOTTOMLEY, A.M. 1948. Gasteromycetes of South Africa. *Bothalia* 4: 473–810.

BRUMMITT, R.K. & POWELL, C.E. 1992. *Authors of plant names.* Royal Botanic Gardens, Kew.

CALONGE, F.D., MATA, M. & CARRANZA, J. 2005. Contribución al catálogo de los Gasteromycetes (Basidiomycotina, Fungi) de Costa Rica. *Anales del Jardín Botánico de Madrid* 62: 23–45.

COETZEE, J.C., EICKER, A. & VAN WYK, A.E. 1997. Taxonomic notes on the Geastraceae, Tulostomataceae, Nidulariaceae and Sphaerobolaceae (Gasteromycetes) *sensu* Bottomley, in southern Africa. *Bothalia* 27: 117–123.

CORTEZ, V.G., BASEIA, I.G. & DA SILVEIRA, R.M.B. 2008. Gasteromicetos (Basidiomycota) no Parque Estadual de Itapuã, Viamão, Rio Grande do Sul, Brasil. *Revista Brasileira de Biociências* 6: 291–299.

CUNNINGHAM, G.H. 1931. The Gasteromycetes of Australasia. XI. The Phallales, Part II. *Proceedings of the Linnean Society of New South Wales* 56: 182–200.

CUNNINGHAM, G.H. 1942. Name changes in the Phallales and Lycoperdales. *New Zealand Journal of Science and Technology* ser. B, 23B: 171B, 172B.

DEMOULIN, V. & DRING, D.M. 1975. Gasteromycetes of Kivu (Zaïre), Rwanda and Burundi. *Bulletin du Jardin Botanique National de Belgique* 45: 339–372.

DRING, D.M. 1973. Gasteromycetes. In G.C. Ainsworth *et al.*, *The Fungi: an advanced treatise*, vol. B: 451–478. Academic Press, New York.

DRING, D.M. 1980. Contributions towards a rational arrangement of the Clathraceae. *Kew Bulletin* 35: 1–96.

EICHELBAUM, F. 1907 [1906]. Beiträge zur Kenntnis der Pilzflora des Ostusambaragebirges. *Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg* Folge 3,14: 1–92.

EICKER, A. & REID, D.A. 1990. *Clathrus transvaalensis*, a new species from the Transvaal, South Africa. *Mycological Research* 94: 422, 423.

FAN, L., LIU, B. & LIU, Y.H. 1994. The Gasteromycetes of China. A supplement to Nova Hedwigia Beiheft 76. *Beihefte zur Nova Hedwigia* 108: 1–72.

FISCHER, E. 1898 [1900]. Phallineae. In A. Engler, *Die natürlichen Pflanzenfamilien*, vol. 1, Abteilung 1**: 276–296. Engelmann Verlag, Leipzig.

FISCHER, E. 1933. Gastromyceteae. In H. Harms, *Die natürlichen Pflanzenfamilien*, edn 2, vol. 7a: 1–122. Duncker & Humblot, Berlin.

FRIES, E.M. 1821. *Systema mycologicum* I. Ex Officina Berlingiana, Lundae.

FRIES, E.M. 1822. *Systema mycologicum* II(1). Ex Officina Berlingiana, Lundae.

FRIES, E.M. 1823. *Systema mycologicum* II(2). Ex Officina Berlingiana, Lundae.

FRIES, E.M. 1828. *Elenchus Fungorum.* Sumptibus Ernesti Mauritii, Gryphiswaldiae.

FRIES, E.M. 1829. *Systema mycologicum* III(1). Sumtibus Ernesti Mauritii, Gryphiswaldae.

FRIES, E.M. 1832. *Systema mycologicum* III(2). Sumbtibus Ernesti Mauritii, Gryphiswaldae.

GAMS, W. 1984. An index to fungal names and epithets sanctioned by Persoon and Fries. *Mycotaxon* 19: 219–270.

GÓMEZ, L.D. 1974. Sobre el género *Colonnaria* Rafinesque. *Revista de Biologia Tropical* 22: 5–10.

GREUTER, W., BRUMMITT, R.K., FARR, E., KILIAN, N., KIRK, P.M. & SILVA, P.C. 1993. NCU-3. Names in current use for extant plant genera. *Regnum Vegetabile* 129. Koeltz Scientific Books, Königstein.

GRYZENHOUT, M. 2007. *Aseroë rubra* (star stinkhorn/starfish fungus, sea anemone fungus/ Afr: sterstinkhoring). *Mycorrhiza Newsletter* 5: 4–5.

HAWKSWORTH, D.L., KIRK, P.M., SUTTON, B.C. & PEGLER, D.N. 1995. *Ainsworth and Bisby's Dictionary of the Fungi*, edn 8. CAB International, Wallingford.

HIBBETT, D.S., BINDER, M., BISCHOFF, J.F., BLACKWELL, M., CANNON, P.F., ERIKSSON, O.E., HUHNDORF, S., JAMES, T., KIRK, P.M., LÜCKING, R., THORSTEN LUMBSCH, H., LUTZONI, F., MATHENY, P.B., MCLAUGHLIN, D.J., POWELL, M.J., REDHEAD, S., SCHOCH, C.L., SPATAFORA, J.W., STALPERS, J.A., VILGALYS, R., AIME, M.C., APTROOT, A., BAUER, R., BEGEROW, D., BENNY, G.L., CASTLEBURY, L.A., CROUS, P.W., DAI, Y.-C., GAMS, W., GEISER, D.M., GRIFFITH, G.W., GUEIDAN, C., HAWKSWORTH, D.L., HESTMARK, G., HOSAKA, K., HUMBER, R.A., HYDE, K.D., IRONSIDE, J.E., KÔLJALG, U., KURTZMAN, C.P., LARSSON, K.-H., LICHTWARDT, R., LONGCORE, J., MIĄDLIKOWSKA, J., MILLER, A., MONCALVO, J.-M., MOZLEY-STANDRIDGE, S., OBERWINKLER, F., PARMASTO, E., REEB, V., ROGERS, J.D., ROUX, C., RYVARDEN, L., SAMPAIO, J.P., SCHÜßLER, A., SUGIYAMA, J., THORN, R.G., TIBELL, L., UNTEREINER, W.A., WALKER, C., WANG, Z., WEIR, A., WEISS, M., WHITE, M.M., WINKA, K., YAO, Y.-J. & ZHANG, N. 2007. A higher-level phylogenetic classification of the Fungi. *Mycological Research* 111: 509–547.

HIBBETT, D.S. & THORN, R.G. 2001. Basidiomycota: Homobasidiomycetes. In D.J. McLaughlin *et al., The Mycota VII Part B, Systematics and evolution*: 121–168. Springer-Verlag, Berlin.

HOSAKA, K., BATES, S.T., BEEVER, R.E., CASTELLANO, M.A., COLGAN, W., DOMÍNGUEZ, L.S., NOUHRA, E.R., GEML, J., GIACHINI, A.J., KENNEY, S.R., SIMPSON, N.B., SPATAFORA, J.W. & TRAPPE, J.M. 2007 [2006]. Molecular phylogenetics of the gomphoid-phalloid fungi with an establishment of the new subclass Phallomycetidae and two new orders. *Mycologia* 98: 949–959.

HOWELL, M. 2006. A Kirstenbosch curiosity. Observations on an interesting fungus that breaks down plant litter to humus. *Veld & Flora* 92: 157.

JACOT GUILLARMOD, A. 1959. *Aseroë* in South Africa. *South African Journal of Science* 55: 282.

JÜLICH, W. 1981. Higher taxa of Basidiomycetes. *Bibliotheca Mycologica* 85: 1–485. Cramer (Gantner Verlag), Vaduz.

KASUYA, T. 2007. Validation of *Aseroë coccinea*. (Phallales, Phallaceae). *Mycoscience* 48: 309–311.

KIRK, P.M., CANNON, P.F., DAVID, J.C. & STALPERS, J.A. 2001. *Dictionary of the Fungi*, edn 9. CABI Publishing, Wallingford.

KIRK, P.M., CANNON, P.F., MINTER, D.W. & STALPERS, J.A. 2008. *Dictionary of the Fungi*, edn 10. CABI Publishing, Wallingford.

KORF, R.P. 1983. Sanctioned epithets, sanctioned names and cardinal principles in ': Pers.' and ': Fr.' citations. *Mycotaxon* 16: 341–352.

KORF, R.P. 1996. Simplified author citations for fungi and some old traps and new complications. *Mycologia* 88: 146–150.

LEITE, A.G., BARBOSA SILVA, B.D., ARAÚJO, R.S. & BASEIA, I.G. 2007. Espécies raras de Phallales (Agaricomycetidae, Basidiomycetes) no Nordeste do Brasil. *Acta Botanica Brasílica* 21,1: 119–124.

LEVIN, H., BRANCH, M., RAPPOPORT, S. & MITCHELL, D. 1985. *A field guide to the mushrooms of South Africa*. Struik, Cape Town.

LIU, B. 1984. The Gasteromycetes of China. *Beihefte zur Nova Hedwigia* 76: 1–235, plus 18 figures.

MAY, T.W., MILNE, J., SHINGLES, S. & JONES R.H. 2003. *Fungi of Australia Vol. 2B. Catalogue and bibliography of Australian fungi 2. Basidiomycota p.p. & Myxomycota p.p.* CSIRO Publishing, Collingwood.

MCNEILL, J., BARRIE, F.R., BURDET, H.M., DEMOULIN, V., HAWKSWORTH, D.L., MARHOLD, K., NICOLSON, D.H., PRADO, J., SILVA, P.C., SKOG, J.E., WIERSEMA, J.H. & TURLAND, N.J. 2006. International Code of Botanical Nomenclature (Vienna Code). *Regnum Vegetabile* 146. Gantner Verlag, Liechtenstein.

MILLER, O.K. & MILLER, H.H. 1988. Gasteromycetes. *Morphological and developmental factors with keys to the orders, families and genera*. Mad River Press, Eureka.

MILLS, A.K., MAY, T.W., FUHRER, B.A., RATKOWSKY, D.A. & RATKOWSKY, A.V. 1997. *Claustula*: the forgotten phalloid. *The Mycologist* 11: 31–35.

MORA, R.N. & GARZA, R.V. 1997. Los macromicetos de la Sierra de Nanchititla, I. *Polibotanica* (5): 21–36.

MORNAND, J. 1993. Contribution a la connaissance des champignons de Maine-et-Loire. 2—Gasteromycetes. *Bulletin de la Société Mycologique de France* 109: 149–163.

PEGLER, D.N. & GOMEZ, L.D. 1994. An unusual member of the cage fungus family. *The Mycologist* 8: 54–59.

RAOUL, E.F.A. ['M.'] 1844. Choix de plantes de la Nouvelle-Zélande. *Annales des Sciences Naturelles. Botanique* sér. 3,2: 113–123.

SANTESSON, R. 1943. The phalloid genera *Colonnaria* Rafinesque, *Laternea* Turpin and *Linderia* Cunningham. *Svensk Botanisk Tidskrift* 37: 287–303.

SWART, H.J. 1959. *Aseroe* (sic) in South Africa. *South African Journal of Science* 55: 192.

TALBOT, P.H.B. 1958. New and interesting records of South African fungi. Part iii. *Bothalia* 7: 109–115.

TKALČEC, Z., MEŠIĆ, A. & ANTONIĆ, O. 2005. Survey of the gasteral Basidiomycota (Fungi) of Croatia. *Natura Croatica* 14: 99–120.

VAN DER WESTHUIZEN, G.C.A. & EICKER, A. 1994. *Field guide. Mushrooms of southern Africa*. Struik, Cape Town.

ZELLER, S.M. 1949. Keys to the orders, families and genera of the Gasteromycetes. *Mycologia* 41: 36–58.

Bothalia 40,2: 161–166 (2010)

Two new species of *Nemesia* (Scrophulariaceae) from the southern Cape, South Africa

K.E. STEINER*

Keywords: *Nemesia* Vent., new species, Scrophulariaceae, South Africa, southern Cape

ABSTRACT

Two new species of *Nemesia* Vent. are described from South Africa. *Nemesia* **fourcadei** is an annual with small white flowers, a yellow-orange pubescent palate, and violet lines at the base of the upper lip. It differs from the similar looking *N. lucida* Benth. by having larger flowers with a more prominent spur (mostly 3.5–4.5 mm long vs < 1.5 mm) and a pubescent palate. *N.* **fourcadei** is known from only two locations in the southern Cape. *N.* **elata** is a facultative perennial with white flowers, a lavender to purple reverse, and a white or very pale yellow palate. It is known only from the Langeberg and Outeniqua Mountains between Swellendam and Montagu Pass. It is closest to *N.* **fourcadei**, but differs from that species by its more robust habit, the absence of a boss inside the corolla tube at the base of the hypochile, and a spur that is violet to purple at the base.

INTRODUCTION

Nemesia Vent. is a genus of ± 62 species of annual and perennial herbs endemic to southern Africa (Steiner 2009). The last revision of the genus appeared in *Flora capensis* near the turn of the last century (Hiern 1904) with a partial revision for species occurring chiefly in KwaZulu-Natal, published more recently (Hilliard & Burtt 1986), and new species continue to be described, especially from arid areas of the Northern Cape Province of South Africa (Steiner 2006, 2009). The purpose of this paper is to describe two new species from the southern Cape region of South Africa. The descriptions are based primarily on living material collected directly from the field or grown from field-collected seed.

Nemesia fourcadei *K.E.Steiner*, sp. nov., *N. lucidae* Benth. proxima, sed differt corrollis maioribus, calcaribus longioribus et palato villoso, nec glabrato.

TYPE.—Western Cape, 3323 (Willowmore): De Vasselot Nature Reserve, at top of Groot River Pass, picnic site at entrance trail, 33°58.037'S 23°32.369'E, ± 215 m, (–DC), 13 Oct. 2002, *Steiner 3981* (NBG, holo.; CAS, K, iso.).

Erect, annual herb, up to 420(–740) mm tall, simple or branching from base; lateral stems up to 260(–520) mm long, rectangular in cross section, corners ridged, sides up to 3.2 mm wide, mostly glabrous with a few, scattered, glandular hairs. *Leaves* decussate, mostly sessile to shortly petiolate; lamina ovate, 5–46 × 4–22 mm, glabrous or with a few sessile glandular trichomes on abaxial surface near base, veins impressed adaxially, 5-nerved abaxially, apex acute, base cuneate; margins sharply dentate; petioles flattened, up to 10 mm long, glabrous or with a few glandular trichomes. *Inflorescence* in short terminal racemes, these elongating up to 210 mm in fruit, glandular-pubescent; bracts alternate, sessile, lowermost leaf-like up to 17 × 10 mm, uppermost gradually reduced to ± 3.6 × 0.8 mm, narrowly lanceolate to narrowly deltoid; base truncate, apex acute to acuminate; margins entire or rarely dentate; with occasional glandular trichomes; pedicels 7.5–8.0 mm long, ascending, dorsally canaliculate, elongating and becoming patent in fruit, densely glandular-pubescent. *Calyx* lobes 5, lanceolate, acute, spreading, sparsely glandular-pilose, upper lobe 3.1–3.6 × 0.7–0.9 mm, upper lateral lobes 3.0–3.5 × 0.8–0.9 mm, lower two lobes ± 3.0 × 1.0–1.4 mm. *Corolla* bilabiate, 7.6–13.2 × 6.9–10.4 mm, upper lip four-lobed, up to 11.3 × 10.4 mm, white with purple veining at base, just above corolla opening, reverse white or tinged with pink veining, two inner lobes erect, oblong to obovate, 2.7–3.5 × 1.6–2.1 mm, obtuse, bases strongly oblique, two outer lobes spreading-recurved, oblong, 3.1–4.0 × 2.1–2.5 mm, truncate or obtuse to emarginate, bases strongly oblique; lower lip oblong-ovate, 5.4–8.7 × 4.8–8.1 mm, emarginate, white with pale yellowish centre, reverse white with purple veining; base with centrally raised, bi-lobed palate; palate 1.2–1.4 × 1.6–2.0 mm, convex, divided by medial groove into two, raised, yellow-orange bosses; bosses densely pubescent with short white or yellow clavate trichomes on top, changing to shorter epidermal papillae on sides and front; corolla tube white with magenta to purple veining; hypochile (floor of corolla tube) 3.6–4.0 × 1.0–1.2 mm, densely covered with long, thinly stalked, clavate trichomes ± 0.1 mm long, varying from whitish to yellowish orange, with a central, raised, laterally compressed boss in basal half near spur entrance, visible on outside of corolla as a narrow medial invagination; boss 1.6–1.9 × 0.8–1.0 mm, base of boss and area surrounding spur entrance densely covered with yellow-orange trichomes; spur ± straight or curving downward slightly, (2.0–)3.0–4.5 mm long, pale greyish green to greyish yellow, containing pale yellow, clavate trichomes for nearly entire length, becoming less dense toward spur tip. *Stamens* 4, whitish, lying in shallow depression, ± 2.0 × 1.5 mm, in upper, inside surface of corolla tube; filaments of anticous pair (twisted into posticous position), 2.5–3.0 mm long, sigmoid, ± straight in middle, glabrous or with few scattered glandular trichomes, posticous pair 1.3–1.5 mm long, curving, glabrous or with few scattered trichomes; anthers 0.5–0.7 mm long, each pair strongly coherent; pollen white. *Ovary* oblong-

---

* Department of Botany, California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco 94118, USA.
MS. received: 2009-11-04.

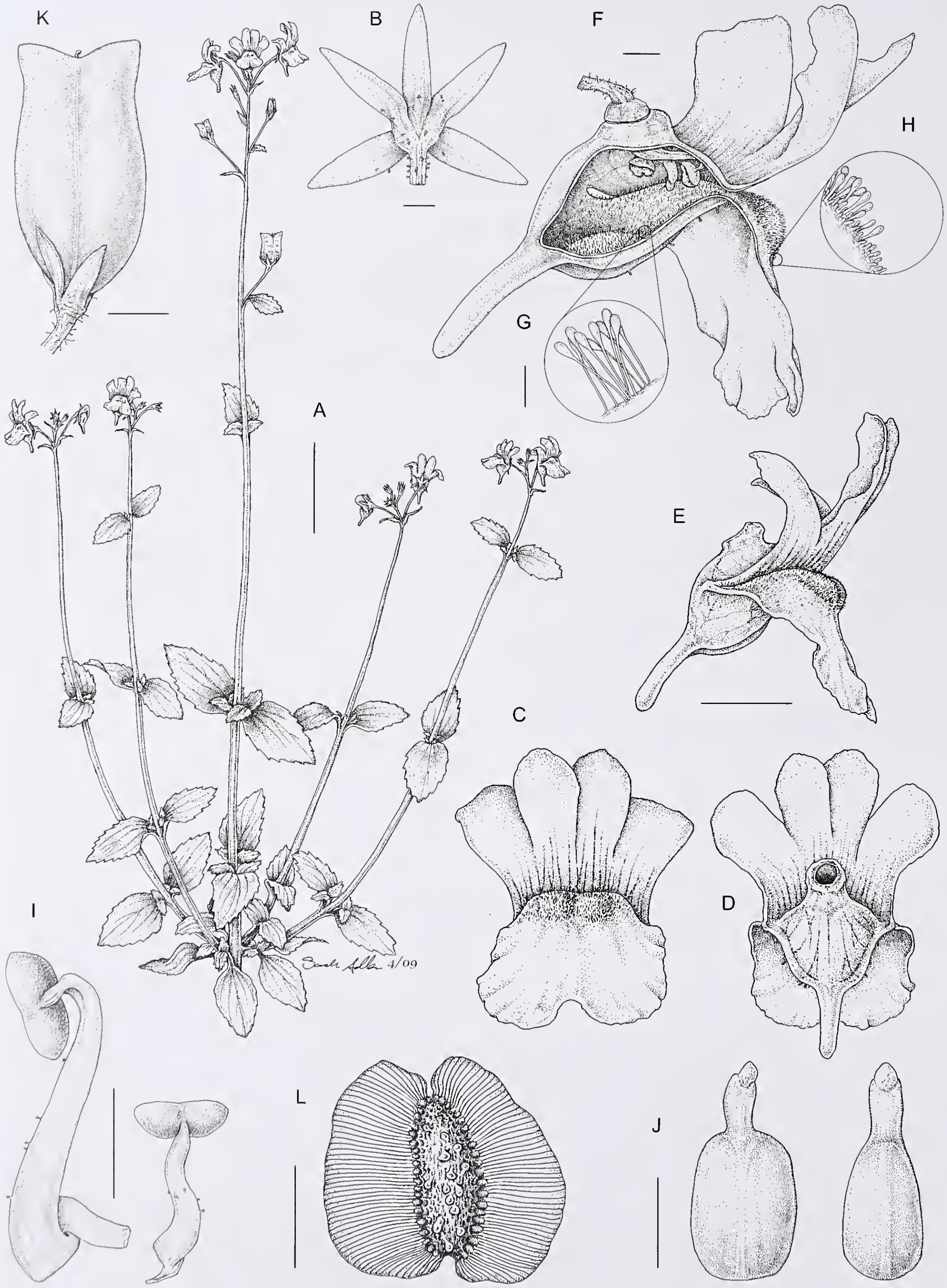


FIGURE 1.—*Nemesia fourcadei*, *Steiner 3981* (CAS, NBG): A, habit; B, calyx. C–H, corolla: C, front view; D, rear view; E, side view; F, side view partially cut away with sepals lobes removed; G, trichomes from hypochile; H, trichomes from palate. I, stamens, anticous (left), posticous (right); J, pistil: side view (left), posterior view (right); K, capsule; L, seed. Scale bars: A, 40 mm; B, F, I, J,1 mm; C–E, 4 mm; G, H, 0.05 mm; K, 4 mm; L, 1 mm. Artist: Sarah Adler.

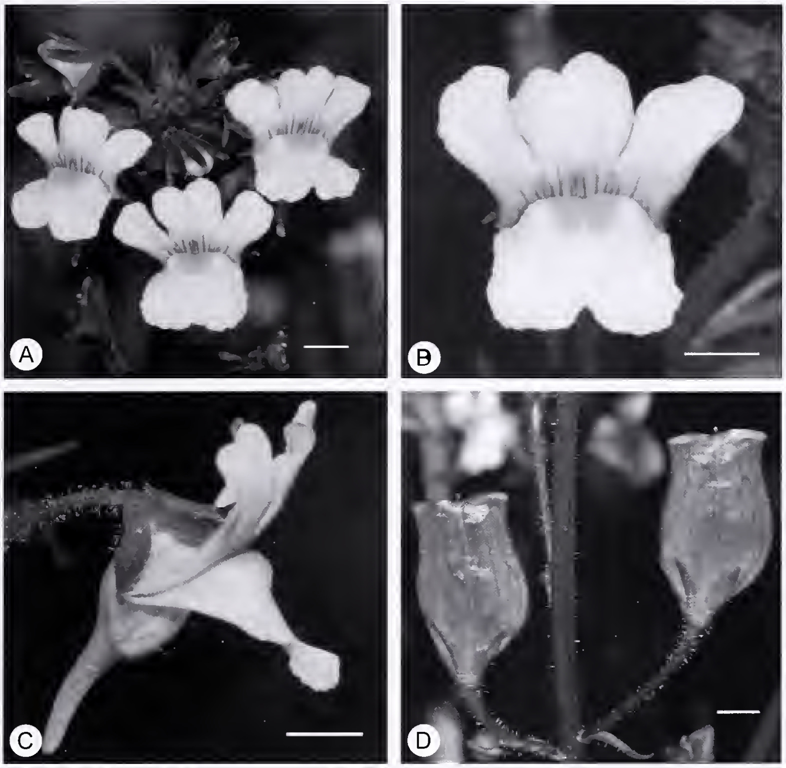


FIGURE 2.—*Nemesia fourcadei*. A, inflorescence. B, C, flower: B, front view; C, side view. D, capsules. Scale bars: all 2.5 mm.

ovate, laterally compressed; 1.5–1.8 × 1.1–1.6 mm; style 0.5–0.7 mm long, compressed somewhat contrary to ovary, apex wider than base, lying between anther pairs with stigma facing away from corolla opening; stigma ± 0.1 × 0.3 mm. *Capsules* oblong-ovoid, laterally compressed contrary to septum, 12–18 × 6.3–8.9 mm, emarginate to bi-lobed, lobes widely diverging. *Seeds* winged, broadly ovate, 2.0–2.5 × 1.8–2.5 mm; wing 0.6–1.1 mm wide, straw-coloured, membranous with numerous parallel, brownish veins encircling seed, except at ends, internal portion of seed elliptical, 1.5–1.9 × 0.3–0.5 mm, with dark brown, verrucate exotesta. *Flowering time*: August to November. Figures 1; 2.

Diagnostic features: *Nemesia fourcadei* is recognized by its white flowers with purple veining and a pale yellowish orange palate. It can be distinguished from the similar looking *N. lucida* by its larger flowers (7.6–13.2 mm vs < 7.5 mm long) with longer spurs (mostly 3.0–4.5 vs < 1.5 mm), and by its relatively broader capsules (length/width: 1.7–2.0 vs 2.4–3.5). It also differs from *N. lucida* in having a pubescent palate. Molecular data from multiple collections of *N. lucida*, using several gene regions, suggest that the resemblance to *N. fourcadei* is only superficial, because the two species occur in different major clades (Steiner unpubl.). *N. fourcadei* groups in a clade containing mostly eastern summer rainfall species, whereas *N. lucida* groups with a clade containing mostly winter rainfall species (Steiner unpubl.). The superficial resemblance of their flowers may be because of convergence based on adaptation to small pollen-collecting bees or it may be the result of relaxed pollinator selection associated with the evolution of autogamy.

Etymology: this plant is named in honour of H.G. Fourcade, who actively collected in the Eastern Cape after he resigned from the Civil Service. His collection of *Nemesia fourcadei*, in addition to his many other collections, served as the basis for a checklist of the flora of George, Knysna, Humansdorp and Uniondale Districts (Fourcade 1941).

Distribution and habitat: *Nemesia fourcadei* is an annual that comes up sporadically after winter rain and is not dependent on fire for germination. It is known from only three sites in the southern Cape, Witelsbos, the De Vasselot Nature Reserve, and Kareedouwkloof near Kareedouw (Figure 3). At Witelsbos, it was collected in grassy places on the margins of Southern Afrotemperate Forest, while at Groot River Pass it grew in a grassy opening on the edge of Garden Route Shale Fynbos (Mucina & Rutherford 2006). No habitat data was given for the Kareedouwkloof specimen.

Breeding systems: *Nemesia fourcadei* is facultatively autogamous. In cultivated individuals isolated from insects, every flower forms a capsule filled with seed. Flowers become progressively smaller once capsule formation begins and as the flowering season progresses, even when plants are supplied with sufficient moisture. The ability of this species to self-pollinate does not preclude the possibility of occasional outcrossing by small bees. The spurs of *N. fourcadei* do not secrete nectar, therefore pollen is the only potential food source for pollinators.

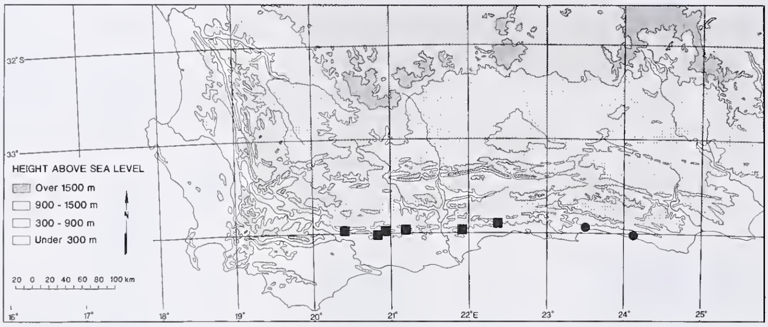


FIGURE 3.—Known distribution of *Nemesia fourcadei*, ●; and *N. elata*, ■.

Other specimens examined

EASTERN CAPE.—3324 (Steytlerville): Kareedowkloof, (–CD), Oct. 1930, *Fourcade s.n.* (NBG).

3424 (Humansdorp): Witelsbos, (–AA), Aug. 1921, *Fourcade 1415* (BOL, K, NBG, PRE, SAM).

Nemesia elata *K.E.Steiner*, sp. nov., *N. fourcadei* proxima, sed differt tubo corollae nec invaginato, basique calcaris violacea.

TYPE.—Western Cape, 3321 (Ladismith): Garcia's Pass, 18.4 km N of Riversdale, N-facing slope in steep gorge below road, 33°57.731'S 21°13.443'E, ± 505 m, (–CC), 8 Oct. 2003, *Steiner 4061* (NBG, holo.; CAS, E, K, PRE, iso.).

Perennial herb or subshrub, up to 1 m tall; stems erect or decumbent, simple or branching; lateral stems up to 43(–80) mm long, rectangular in cross section with corners ridged, up to 4.9(–5.1) × 3.1(–5.1) mm, often fleshy, glabrous. *Leaves*, opposite, sessile to petiolate; lamina lanceolate to ovate, (7–)18–77(–87) × (4.7–)10–37(–45) mm, apex acute to acuminate, base cuneate; margins sharply dentate; veins impressed adaxially, 5–7-nerved abaxially, glabrous; petioles up to 20 mm long, canaliculate, decurrent, glabrous. *Inflorescence* of solitary alternate flowers, in lax, bracteate racemes, or subcorymbose, up to 480(–660) mm long, glabrous, developing long internodes in fruit; bracts alternate (occasionally opposite), sessile or with petioles up to 3 mm long, lowermost leaf-like, up to 62 × 32 mm, uppermost gradually reduced to 8.4 × 0.8 mm, narrowly lanceolate to linear, apex acute to acuminate, base truncate; margins entire or with a few widely spaced teeth, with occasional sessile glandular trichomes; pedicels 8–20 mm long, ascending, dorsally canaliculate, mostly glabrous, sparsely glandular-pubescent apically, elongating up to 23 mm and ascending in fruit. *Calyx* lobes 5, narrowly lanceolate, spreading, glabrous, upper lobe 2.7–3.6 × 0.6–0.7 mm, upper lateral lobes 2.8–3.6 × 0.7–0.8 mm, lower two lobes ± 2.9–3.1 × 0.8–0.9 mm, acute; margins scabridulous. *Corolla* bilabiate, (7.3–)9.2–12.0 × (6.5–)8.7–10.8 mm, upper lip white, reverse violet, with faint, grey-blue lines at base above corolla opening, four-lobed, up to 9.2 × 10.8 mm, two inner lobes oblong, 2.3–3.3 × 1.6–2.6 mm, obtuse, bases oblique, two outer lobes oblong, 4.2–4.8 × 2.5–3.0 mm, bases strongly oblique, rounded; lower lip widely obovate, obtuse to emarginate, 7.9–8.9 × 8.1–9.4 mm, white; base of lower lip with raised palate, 1.4–2.4 × 4.2–4.7 mm, convex, white to pale greyish yellow, often bisected by thin grey line, densely pubescent with clavate trichomes, these transitioning distally to shorter, papillate, epidermal cells; hypochile 3.4–4.3 × 2.3–2.4 mm, V- to U-shaped in cross section with purple veining, densely covered with white clavate trichomes with long thin stalks ± 0.2 mm long, base of tube spurred, spur 3.4–4.1 mm long, projecting backwards and decurved in distal half, basal portion lavender to purple, distal half greyish green, glabrous outside, pubescent with white, clavate trichomes inside for ± half the length. *Stamens* 4, whitish, lying in shallow depression, 1.6–1.9 × 1.0–1.1 mm, in upper inner surface of corolla tube; anticous filaments (twisted into posticous position) 2.5–2.7 mm long, sigmoid, but ± straight in middle, glabrous, posticous filaments ± 0.8–0.9 mm long, ± straight except at base where they are strongly curved; anthers 0.6–0.8 mm long, each pair strongly coherent; pollen white. *Ovary* oblong-ovoid, laterally compressed, 0.9–1.2 × 0.8–1.0 mm; style ± straight, slightly compressed contrary to ovary, lying between anther pairs; stigma oblong-ovate, 0.3 × 0.25 mm. *Capsules* solitary to subfasciculate, oblong in outline, laterally compressed contrary to septum, bivalvate, 8.0–13.0 × 4.7–6.3 mm, emarginate with two widely diverging acute tips. *Seeds* winged, broadly ovate, 1.9–2.2 × 1.9–2.1 mm, wing 0.4–0.7 mm wide, encircling seed except at ends, light brown, membranous with numerous parallel, brownish veins, internal portion of seed lanceolate in outline, 1.7–2.1 × 0.8–1.0 mm, with reticulate and verrucate, dark brown exotesta. *Flowering time*: (May–)August to December. Figures 4, 5.

Diagnostic features: *Nemesia elata* is recognized by its small flowers that are white with a violet to purplish reverse, with one or more faint greyish blue lines at the base of the upper lip and a densely pubescent white or very pale yellow palate. Although *N. elata* is perennial, it does not have a strong root system and may occasionally die back to the ground if conditions become too dry. It can be distinguished from *N. fourcadei* by its perennial habit, the absence of a narrow invagination of the corolla tube near the spur opening, and the presence of violet to purple on the lower half of the spur. It can resemble *N. melissifolia* Benth. in fruit, because of the development of long internodes and the quasifasciculate capsules of robust specimens (Hilliard & Burtt 1986). However, that species is a bushy annual that has flowers with longer, narrower, acute spurs mostly 5–8 mm long, and a corolla tube with two bosses inside near the spur opening. *N. elata* is also similar to *N. diffusa* Benth., but that species is less robust, has a glandular-pubescent

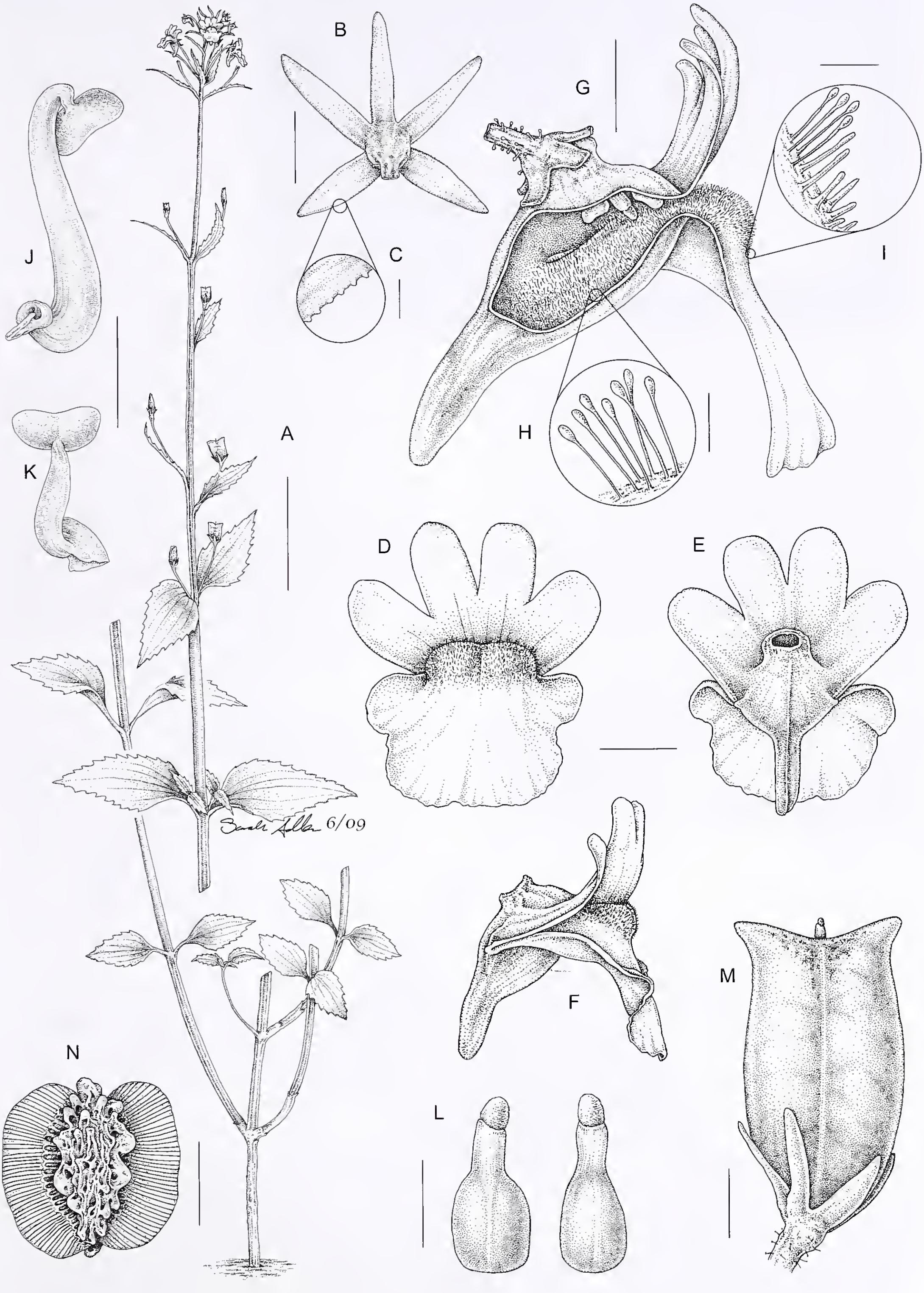


FIGURE 4.—*Nemesia elata*, *Steiner 4057* (CAS, NBG): A, habit; B, C, calyx, enlargement of calyx margin. D–I, corolla: D, front view; E, rear view; F, side view; G, side view partially cut away with sepal lobes partly removed; H, enlargement of trichomes from hypochile; I, enlargement of trichomes from palate. J, K, stamens: J, anticous; K, posticous. L, pistil: side view (left), posterior view (right); M, capsule; N, seed. Scale bars: A, 40 mm; B, G, 2 mm; C, 0.25 mm; D–F, M, 3 mm; H, I, 0.1 mm; J–L, N, 1 mm. Artist: Sarah Adler.

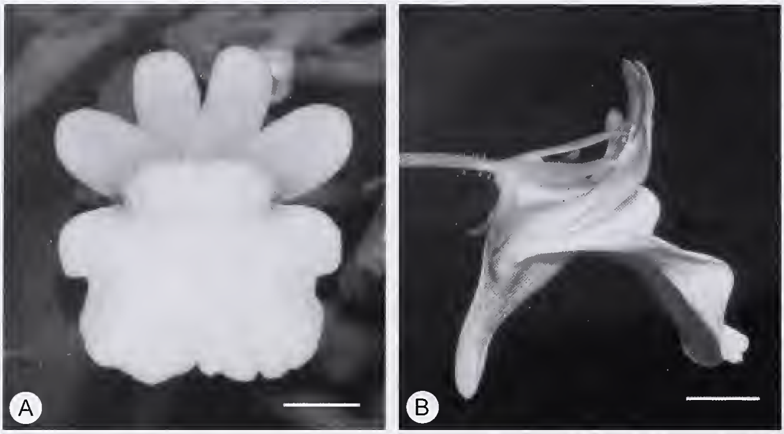


FIGURE 5.—*Nemesia elata.* A, B, flower: A, front view; B, side view. Scale bars: 2.5 mm.

calyx, and more prominent blue-purple lines that extend more than halfway into the corolla lobes on both front and back. This species was referred to as *Nemesia* sp. 2 in Goldblatt & Manning (2000).

Etymology: the epithet *elata* refers to the tall (lofty) stature of the species.

Distribution and habitat: *Nemesia elata* occurs in the Langeberg and Outeniqua Mountains from Swellendam to Montagu Pass, near George (Figure 3). It is found in openings in fynbos in moist sandy loam, especially on steep slopes in gorges and ravines between 250 to 750 m. It is most common after fire.

Breeding systems: *Nemesia elata* is facultatively autogamous. In cultivation, when pollinators are excluded, all flowers form capsules and set seed. The ability of this species to self-pollinate, however, does not preclude the possibility of occasional outcrossing by small bees or flies. The spurs of *N. elata* do not secrete nectar, but pollen may function as an attractive food source for pollinators.

Other specimens examined

WESTERN CAPE.—3320 (Montagu): Swellendam State Forest, Kliprivier (Hermitage) Gorge, ± 800', (–CD), 11 Oct. 1973, *Haynes 831* (PRE); Grootvadersbos, eastern part, 442 m, (–DD), 21 May 1983, *C.M. van Wyk 1211* (PRE). 3321 (Ladismith): Garcia's Pass, 16.5 km N of Riversdale, 33°58.591'S 21°13.168'E, 545 m, (–CC), 7 Oct. 2003, *Steiner 4059* (NBG, CAS); Garcia's Pass, 18.4 km N of Riversdale, S33°58.623' E21° 13.327', 505 m, (–CC), 20 Aug. 2004, *Steiner 4067* (NBG, CAS); Garcia's Pass, (–CC), Sep. 1908, *Phillips* 312 (E, K); Cloete's Pass and Goliatsberg, up to 530 m, (–DD), 14 May 1915, *Muir 2028* (PRE). 3322 (Oudtshoorn): Outeniqua Montagu Pass on wet rocks, ± 688 m, (–CD), Oct. 1921, *Fourcade 1594* (K); mountains at top of Montagu Pass, after fire, 750 m, (–CD), 5 Oct. 1985, *Vlok 1174* (PRE). 3420 (Bredaspdorp): Grootvadersbosch (Eastern Part), (–BB), 6 Dec. 1953, *Taylor 1038* (PRE).

ACKNOWLEDGEMENTS

I thank Eastern Cape Nature Conservation for permission to collect in the De Vasselot Nature Reserve. I also thank Sarah Adler for the line drawings of *N. fourcadei* and *N. elata.* I am grateful to the Compton Herbarium staff for use of their facilities. I also thank the South African National Biodiversity Institute for *Nemesia* loans from NBG and PRE.

REFERENCES

FOURCADE, H.G. 1941. A checklist of the flora of George, Knysna, Humansdorp and Uniondale Districts. *Memoirs of the Botanical Survey of South Africa* No. 20.

GOLDBLATT, P. & MANNING, J. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9: 657. National Botanical Institute, Cape Town and Missouri Botanical Garden, St Louis.

HIERN, W.P. 1904. Scrophulariaceae. In W.T. Thiselton-Dyer, *Flora capensis* 4,2: 121–420. Reeve, London.

HILLIARD, O.M. & BURTT, B.L. 1986. Notes on some plants of southern Africa chiefly from Natal: XIII. *Notes from the Royal Botanic Garden Edinburgh* 43: 345–405.

MUCINA, L. & RUTHERFORD, M.C. (eds). 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

STEINER, K.E. 2006. Two new species of *Nemesia* (Scrophulariaceae) from southern Africa. *Bothalia* 36: 39–44.

STEINER, K.E. 2009. Two new species of *Nemesia* (Scrophulariaceae) from arid areas of the Northern Cape, South Africa. *Bothalia* 39: 109–114.

Bothalia 40,2: 167–204 (2010)

Notes on African plants

VARIOUS AUTHORS

VITACEAE

THE STATUS OF *CYPHOSTEMMA UNGUIFORMIFOLIUM* IN SOUTHERN AFRICA

The transfer of *Cissus schlechteri* Gilg & M.Brandt and *C. unguiformifolius* C.A.Sm. to the genus *Cyphostemma* (Planch.) Alston was made by Descoings (1967). However, by this date of publication, Wild & Drummond (1966) had already included the taxon *Cissus unguiformifolius* within *Cyphostemma schlechteri*, a notion which has been largely upheld (Lebrun & Stork 1992; Retief & Herman 1997; Retief 2006), with one notable exception (Verdcourt 1991) (see protologue for *C. pseudoburgeri* Verdc. 1991: 88). Subsequent field work, and consideration of literature and herbarium specimens from South Africa and adjacent countries revealed a need to separate these two taxa. This decision was based on observed differences in growth form, leaf succulence, tendrils, inflorescences (Figures 1, 2), and distribution patterns (Figure 3).

Furthermore, it was also established that *Cyphostemma unguiformifolium* actually exhibits a growth form and morphological characters identical to that of an earlier described species, *C. omburense* (Gilg & M.Brandt) Desc.; accordingly, *C. unguiformifolium* is relegated to the synonymy of this species. Although the leaves of *C. omburense* have been observed as 3–7-foliolate (Merxmüller & Schreiber 1969), we have noted that juvenile leaves appear first as 3-foliolate prior to development of at least two further leaflets. The description of *C. omburense* is based on a specimen Dinter collected in Namibia and the taxon was considered a Namibian endemic (Craven & Loots 2002; Retief 2003). Its distribution in southern Africa now includes Namibia, Botswana, Swaziland, and Limpopo, Mpumalanga, KwaZulu-Natal provinces in South Africa. The species also extends into Zimbabwe and Mozambique.

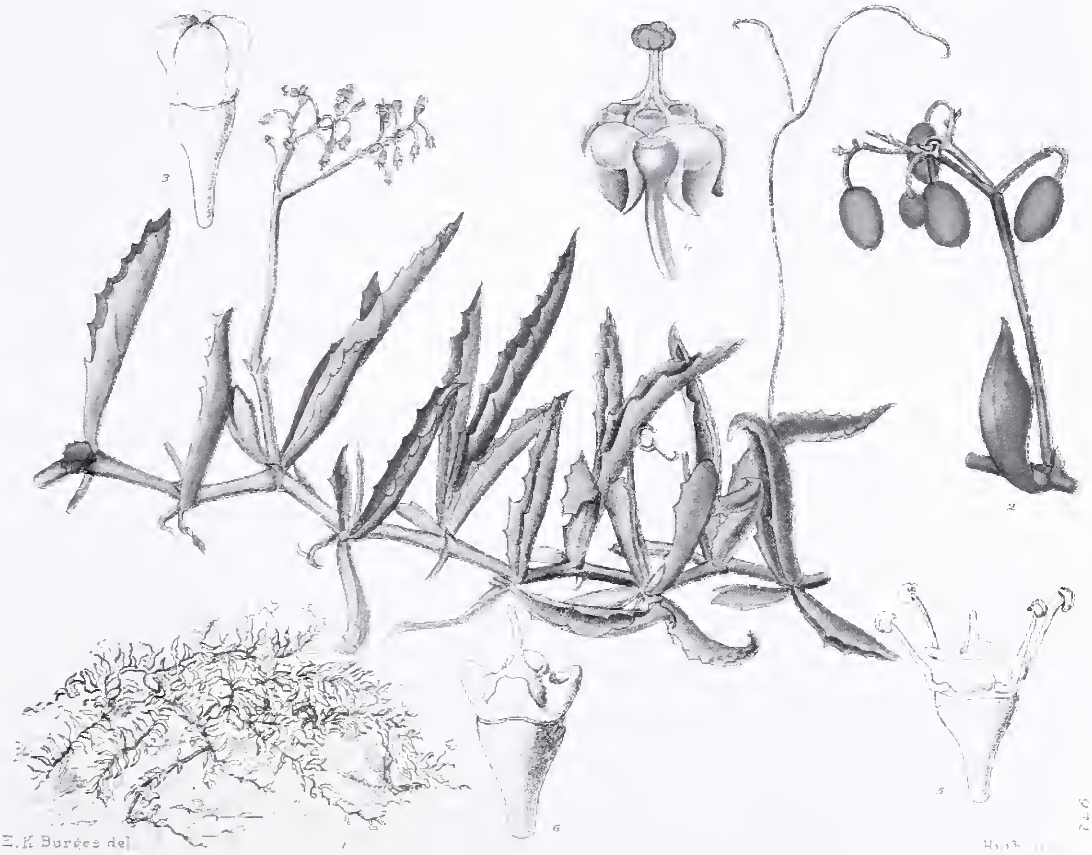


FIGURE 1.—*Cyphostemma omburense* (= *C. unguiformifolium*) with trailing habit, from Verdoorn (1946).

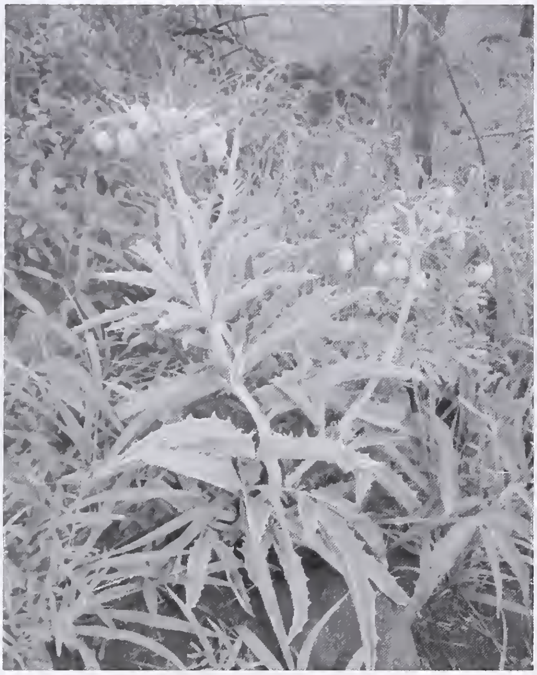


FIGURE 2.—*Cyphostemma schlechteri* in habitat, Imfolozi Game Reserve, Zululand, showing suberect habit. Photograph: N. Crouch.

Both *Cyphostemma schlechteri* and *C. omburense* are glabrous and glaucous with sessile or subsessile leaves, but are geographically isolated in the main, though distributions overlap in the Lebombo Range (Figure 3). These closely related *Cyphostemma* species, both of which are usually 5-foliolate, may be separated using the following key:

1a Plants procumbent, long trailing stems up to 1 m long; leaves (3–)5(–7)-foliolate, subfleshy; leaflets 15–120 × 2–20 mm; tendrils prominent, forked or with a monofilament, often curly at apex; inflorescences terminal on lateral branchlets (appearing axillary) .... *C. omburense*
1b Plants erect to suberect, 0.50 m high; leaves (3–)5-foliolate, fleshy; leaflets 60–170 × 16–30 mm; tendrils rarely curly; inflorescences axillary on only distal lateral branches (appearing terminal) .... *C. schlechteri*

1. **Cyphostemma omburense** *(Gilg & M.Brandt) Desc.* in Naturalia Monspeliensia (Séne Botanique) 18: 225 (1967). *Cissus omburensis* Gilg & M.Brandt: 518 (1912). Type: Namibia, Omburo, *Dinter 1408* (B, holo.†).

Cissus unguiformifolius C.A.Sm.: xx (1932). *Cyphostemma unguiformifolium* (C.A.Sm.) Desc.: 229 (1967). Type: South Africa, Zoutpansberg Dist., Messina, *Pole Evans H13119* (PRE, holo.!, K, iso.!).

2. **Cyphostemma schlechteri** *(Gilg & M.Brandt) Desc. ex Wild & R.B.Drumm.* in Flora zambesiaca 2,1: 463 (1966) pro parte. *Cissus schlechteri* Gilg & M.Brandt: 489 (1912); Suesseng.: 174 (1953). Type: Mozambique, Ressano Garcia, *Schlechter 11893* (B, holo.†).

SPECIMENS EXAMINED

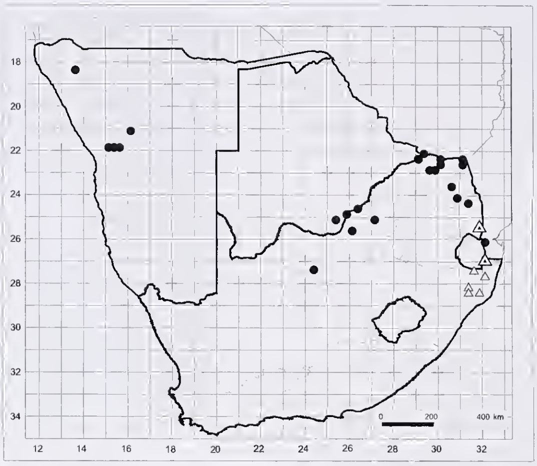


FIGURE 3.—Known distributions in *FSA* region of *Cyphostemma omburense* (= *C. unguiformifolium*), ●; *C. schlechteri*, △; and both taxa, ⚠.

Numbers in brackets signify the identity of the specimens: (1) *Cyphostemma omburense*; (2) *C. schlechteri*.

Acocks 13007 (2) PRE.

Braun 589 (1) PRE. *Bremekamp & Schweickerdt 309* (1) PRU. *Bydendyk PRE28780* (1) PRE.

Codd 5986, 8852 (1) PRE. *Cole 1159, 1165* (1) PRE. *Crouch 1212* (2) PRE.

De Winter & Leistner 5560 (1) PRE, WIND. *B. Dlamini PRE48159* (2) PRE. *Downing 623* (2) NU, PRE; *327* (2) K.

Eicker & students (8-01-1973) (1) PRE, PRU.

Germishuizen 512 (1) PRE. *Gerstner 6026* (1) PRE; *700* (2) K, PRE; *4603, 6260* (2) PRE. *Giess 10455, 11327* (1) PRE, WIND.

Hillary & Robertson 498 (1) PRE. *Hitchins 290* (2) NU, PRE. *Hutchinson 2953* (1) K, PRE.

Jacobsen, N.H.G. 5853 (1) PRE.

Kemp 1157 (2) PRE.

Liebnitz, Fakude & Hancox 11 (2) NU, PRE. *Louw 613* (1) PRE; *1894, 2519* (1) PRU.

Merxmüller & Giess 1402 (1) PRE, WIND. *Miller B843, B792* (1) PRE.

Nel 85 (2) NH, PRE. *Netshiungani 818* (2) PRE.

Oates 138, 272 (1) PRE. *Obermeyer, Schweickerdt & Verdoorn 330* (1) PRE.

Pienaar 321 (1) K, PRE. *Pole Evans PRE13119* (1) K, PRE.

Rogers 13432 (1) PRE; *20386, 22204* (1) K. *Ross 2396* (2) PRE.

Singh 179 (2) NH. *Straub 920* (1). *Strey 9137* (2) PRE.

Theron 2819 (1) PRE, PRU. *Thode A1370* (1) K, PRE.

F. van der Merwe, 36 (1) PRE. *Van der Schijff 2488, 3971, 3304* (1) PRE. *Van Rooyen 193* (1) PRU. *Venter 12195* (1) PRE; *5205* (2) PRE. *Visser L13* (1) PRE.

Ward 1663 (2) NH, NU, PRE; 10871 (1) PRE, WIND.

G. Zambatis G, GZ257 (1) PRE. *N. Zambatis1258* (1) PRE.

ACKNOWLEDGEMENTS

The curators of the following herbaria: K, NH, NU, PRE, PRU and WIND (acronyms as in Holmgren *et al.* 1990), are thanked for permission to access their respective Vitaceae collections. The assistance of the staff of the Mary Gunn Library, Mrs H. Snyman for producing the distribution map, and Dr Hugh Glen (nomenclatural discussions and translations of German and Latin texts), all of the South African National Biodiversity Institute, is gratefully acknowledged. Two anonymous referees are thanked for their helpful comments on the manuscript.

REFERENCES

CRAVEN, P. & LOOTS, S. 2002. Vitaceae/Namibia. In J. Golding, *Southern African plant Red Data Lists*. Southern African Botanical Diversity Network Report No. 14: 84.

DESCOINGS, B. 1967. Note rectificative a propos de la nomenclature des *Cyphostemma* (Vitacées). *Naturalia Monspeliensia (Séne Botanique)* 18: 217–230.

GILG, E. & BRANDT, M. 1912. Vitaceae africanae. In A. Engler, *Botanische Jahrbücher* 46: 415–557.

HOLMGREN, P.K., HOLMGREN, N.H. & BARTLETT, L.C. 1990. *Index herbariorum*, edn 8. *Regnum vegetabile* 120. New York Botanical Gardens, Bronx, New York.

LEBRUN, J.-P. & STORK, A.L. 1992. *Énumeration des plantes à fleurs d'Afrique tropicale*. II. Chrysobalanaceae à Apiaceae. Conservatoire et Jardin botaniques, Geneve.

MERXMÜLLER, H. & SCHREIBER, A. 1969. Vitaceae. *Prodromus einer Flora von Südwestafrika* 80: 1–8.

RETIEF, E. 2003. Vitaceae. In G. Germishuizen & N.L. Meyer, Plants of southern Africa: an annotated checklist. *Strelitzia* 14: 946–949.

RETIEF, E. 2006. Vitaceae. In G. Germishuizen, N.L. Meyer, Y. Steenkamp & M. Keith, *A checklist of South African plants*. Southern African Botanical Diversity Network Report No. 41: 850–853.

RETIEF, E. & HERMAN, P.J. 1997. Vitaceae. Plants of the northern provinces of South Africa: keys and diagnostic characters. *Strelitzia* 6: 647–650. National Botanical Institute, Pretoria.

SMITH, C.A. 1932. *Cissus* L. Ampelidàceae. In J. Burtt-Davy, *A manual of the flowering plants and ferns of the Transvaal with Swaziland, South Africa. Part II. Malvaceae to Umbelliferae*: 471–477. Longmans, Green, London.

SUESSENGUTH, K. 1953. Vitaceae. In A. Engler & K. Prantl, *Die natürlichen Pflanzenfamilien*, edn 2, 20d: 174–333.

VERDCOURT, B. 1991. Vitaceae. In R.M. Polhill, *Flora of tropical East Africa*: 1–149.

VERDOORN, I.C. 1946. *Cissus unguiformifolius*. *The Flowering Plants of Africa* 25: t. 972.

WILD, H., & DRUMMOND, R.B. 1966. Vitaceae. In A.W. Exell, A. Fernandes & H. Wild, *Flora zambesiaca* 2,1: 439–492.

E. RETIEF* and N.R. CROUCH**

---

* National Herbarium. South African National Biodiversity Institute, Private Bag X101, 0001 Pretoria. E-mail: E.Retief@sanbi.org.za.

** Ethnobotany Unit, South African National Biodiversity Institute, P.O. Box 52099, 4007 Berea Road, Durban, School of Chemistry, University of KwaZulu-Natal, 4041 Durban. E-mail: N.Crouch@sanbi.org.za.

MS. received: 2009-08-28.

IRIDACEAE

GEOSIRIS ALBIFLORA (GEOSIRIDOIDEAE), A NEW SPECIES FROM THE COMORO ARCHIPELAGO

INTRODUCTION

Fruiting specimens of *Geosiris* H.Baill., a genus until now thought to be restricted to the island of Madagascar and to be monospecific (Perrier 1946; Goldblatt 1991), were discovered in 1989 in the Comoro Archipelago on the island of Mayotte, which lies some 320 km northwest of northern Madagascar. Plants were recollected there in bloom in 1999. Not only is the presence of *Geosiris* a significant range extension for the genus, but the plants on Mayotte represent a different species from the endemic Madagascan *G. aphylla* H.Baill.

Geosiris, an achlorophyllous and leafless saprophyte, was initially referred to Iridaceae (Baillon 1894) but was subsequently believed to belong to Burmanniaceae, a family of saprophytic plants, or to be a separate family Geosiridaceae (Jonker 1939) because of its specialized life history and distinctive, dust-like seeds. The genus was, however, anomalous in Burmanniaceae because it has three stamens, characteristic of the Iridaceae among the petaloid monocots. *Geosiris* was referred with confidence to that family in 1997 as a result of anatomical and flavonoid investigation (Goldblatt *et al.* 1987), which showed it to have all the important synapomorphies of Iridaceae: an inferior ovary; three stamens opposite the outer tepals; extrorse anther dehiscence; calcium oxalate crystals in the form of styloids in some tissues (but not in the scale-like leaves); and a flavonoid profile consistent with Iridaceae. Styloids and other calcium oxalate crystals are absent in Burmanniaceae, as are flavonoid compounds, although the family is poorly sampled for this feature.

The assignment of *Geosiris* to Iridaceae was subsequently confirmed by molecular study: plastid DNA sequences place the Australasian *Patersonia* R.Br. as sister to *Geosiris*, in turn sister to the Afro-Madagascan *Aristea* Aiton (± 55 species), which is sister to a dichotomy yielding the remaining Nivenioideae (*Klattia* Baker, *Nivenia* Vent. and *Witsenia* Thunb.) and the large, old-World and predominantly sub-Saharan African Crocoideae (Reeves *et al.* 2002; Goldblatt *et al.* 2006, 2008). *Geosiris* remains unique in Iridaceae in being achlorophyllous, having non-green, scale-like leaves, minute seeds and a mycosaprophytic life form.

Geosiris is currently the only genus of subfamily Geosiridoideae (Goldblatt *et al.* 2008). Using molecular clock techniques for dating the age of genera of Iridaceae, *Geosiris* has variously been postulated to have diverged from the Australasian *Patersonia* ± 55 mya (Goldblatt *et al.* 2008) or as much as 70 mya (Janssen & Bremer 2004). Age estimates for *Geosiris* are, however, only marginally relevant to the occurrence of *Geosiris* on Mayotte as the island, of volcanic origin, is estimated to be ± 7.7 my in age (Schlüter 2006). Dispersal of the genus across the relatively short distance of ± 320 km from the northwest coast of Madagascar to Mayotte must then have occurred later than this.

Geosiris aphylla (Figure 4) is a small plant ± 100 mm high, with minute, scale-like leaves, a simple or branched stem, and a few to several biseriate inflorescences crowded at the branch tips. The small, blue-violet flowers are sometimes described as purple. The tepal bases and throat are white with darker violet edges, and the outspread tepals

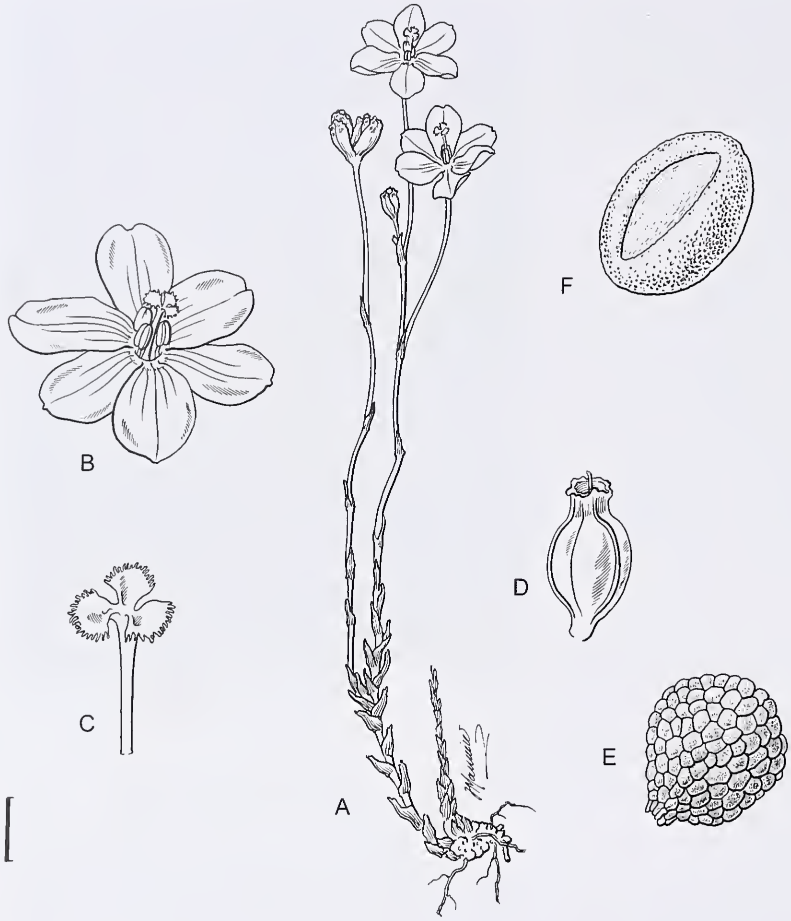


FIGURE 4.—*Geosiris aphylla* (from Goldblatt & Manning 2008). A, whole plant; B, flower; C, stigma; D, capsule; E, seed; F, pollen grain. Scale bar: A, 10 mm; B, 4 mm; C, 2 mm; D, 5 mm; E, 0.1 mm; F, much enlarged. Artist: John Manning.

are basally united in a rudimentary tube, ± 1.5 mm long. The three stamens are erect and initially appressed to the erect style, which exceeds the anther tips and terminates in three, broad, fringed stigmatic lobes. Unusual for the Iridaceae, the axile placentas are branched and accommodate hundreds of ovules. Recent collections have confirmed that the flowers are sweetly scented (e.g. *Zjhra & Hutcheon 170* MO; *Dorr et al. 4431* MO). After flowering, the short-lived perianth collapses but remains attached to the developing capsule as a dry, spirally twisted cap. The three-locular capsules have dry-membranous walls (on herbarium specimens they are translucent) and are evidently indehiscent. The walls fragment irregularly, releasing hundreds of minute seeds, sometimes described as dust-like. Microscopically, the seeds are ovoid with reticulate sculpturing, and measure 0.25 × 0.2 mm.

Plants from Mayotte are vegetatively similar to *Geosiris aphylla* apart from their inflorescence spathes, which are streaked with brown when dry in contrast to the unmarked spathes of *G. aphylla*. The flowers of the Mayotte plants, however, are significantly different from those of *G. aphylla*. A photograph (F. Barthelat pers. comm.) shows a uniformly white perianth, narrowly lanceolate or ± elliptic tepals, ascending stamens diverging away from the style, which is notched apically into minute stigmatic branches. This contrasts markedly with the broadly lobed and fringed style branches of *G. aphylla*, evident in photographs of the species (Goldblatt & Manning 2008). Examination of herbarium specimens of the Mayotte plants also shows that the style reaches the level of the anther tips, whereas the style of *G. aphylla* overtops the anthers by about the length of the anthers, ± 1.2 mm.

We note here that one more species of *Geosiris* has been discovered in Madagascar (P.B. Phillipson pers. comm.) but material for study and for drawing up a formal description is not yet available.

SYSTEMATICS

Geosiris albiflora *Goldblatt & J.C. Manning*, sp. nov.

Plantae achlorophyllosae, *Geosiris aphyllae* similis sed floribus albis, tepalis anguste lanceolatis-ellipticis, staminibus divergentibus, antheris ± 1 mm longis, stylo apices antherarum attingente ad apicem minute trifurcato.

TYPE.—Mayotte: Mt Choungi, under trees in humus, 2 May 1999, *M. Pignal, A. Pibot & C. Mas 1433* (P, holo.).

Plants 60–100 mm high, achlorophyllous, with slender, simple or branched stems arising from a short thick underground rhizome, ± 10 mm long, up to 5 mm diam. *Leaves* scale-like, clasping stem, 2.5–3.5 mm long, membranous, translucent with lines of brown pigment.

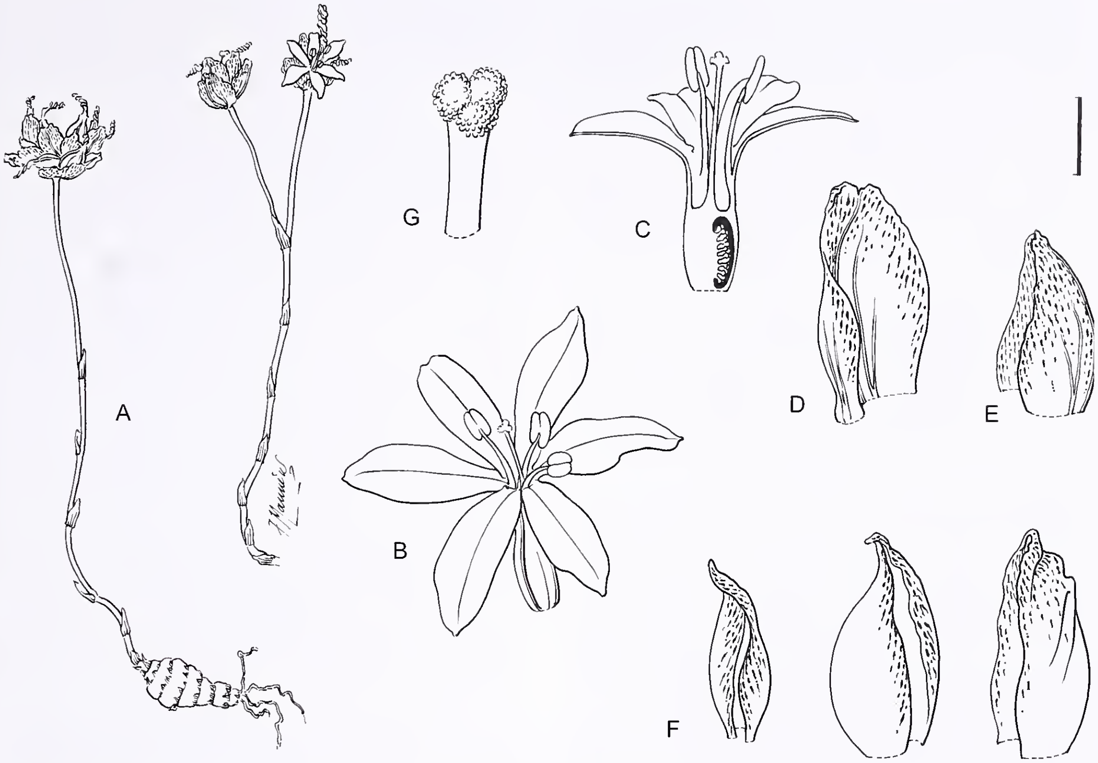


FIGURE 5.— *Geosiris albiflora*, *Tinguy 1097* (P) and *Mas 118* (P). A, whole fruiting plant and flowering stem; B, flower; C, half-flowers; D, outer spathe; E, inner spathe; F, floral bracts from first, second and third flowers of partial rhipidium (in series from right to left); G, stigma. Scale bar: A, 10 mm; B–F, 2 mm; G, 1 mm. Artist: John Manning.

Inflorescences biseriate, crowded, with subsessile flowers; outer spathes opposed, 4–5 mm long, membranous with lines of brown pigment; floral bracts similar. *Flowers* white, erect, radially symmetric; perianth tube ± 1.8 mm long; tepals lanceolate-elliptic, subequal, ± 3 × 1 mm. *Stamens* diverging; filaments exserted ± 1 mm from tube; anthers ± 1.2 mm long, sub-basifixed. *Ovary* ovoid, ± 1.5 mm long; style erect, ± 4 mm long, reaching level of anther tips, minutely 3-fid. *Capsules* broadly ovoid to globose, dry membranous, ± 2 × 1.5–2.0 mm. *Seeds* numerous, ovoid, ± 0.25 × 0.2 mm, reticulate, seeming dark to the naked eye, but light brown with darker muri under 50× magnification. Figure 5.

Additional specimens examined

MAYOTTE.—Mt Choungi, under trees in leaf litter, 29 Dec. 1989 (fr.), *H. Tinguy 1097* (P), in humus, 2 May 1999, *C. Mas 118* (P).

REFERENCES

BAILLON, H. 1894. Une Iridacée sans matière verte. *Bulletin Mensuel de la Société Linnéenne de Paris* 2,146: 1149–1150.

GOLDBLATT, P. 1991. Iridaceae—Famille 45 (2me édition). *Flore de Madagascar et des Comores*: 1–45. Museum National d'Histoire Naturelle, Paris.

GOLDBLATT, P. & MANNING, J.C. 2008. *The iris family: natural history and classification*. Timber Press, Portland, OR.

GOLDBLATT, P., DAVIES, T.J., MANNING, J.C., POWELL, M.P., VAN DER BANK, M. & SAVOLAINEN, V. 2008. Iridaceae 'Out of Australasia'? Phylogeny, biogeography, and divergence time based on plastid DNA sequences. *Systematic Botany* 33: 495–508.

GOLDBLATT, P., DAVIES, T.J., MANNING, J.C., VAN DER BANK, M. & SAVOLAINEN, V. 2006. Phylogeny of Iridaceae subfamily Crocoideae based on combined multigene plastid DNA analysis. In J.T. Columbus, E.A. Friar, J.M. Porter, L.M. Prince & M.G. Simpson, *Monocots: comparative biology and evolution* 1: 399–411. Rancho Santa Ana Botanical Garden, Claremont, California.

GOLDBLATT, P., RUDALL, P., CHEADLE, V.I., DORR, L.J. & WILLIAMS, C.A. 1987. Affinities of the Madagascan endemic *Geosiris*, Iridaceae or Geosiridaceae. *Bulletin du Muséum d'Histoire Naturelle*, 4 sér., sect. B. *Adansonia* 9: 239–248.

JANSSEN, T. & BREMER, K. 2004. The age of major monocot groups inferred from 800+ rbc*L* sequences. *Botanical Journal of the Linnean Society* 146: 385–398.

JONKER, F.P. 1939. Les Géosiridacées, une nouvelle famille de Madagascar. *Recueil Travaux Botaniques Néerlandais* 36: 473–479.

PERRIER DE LA BÂTHIE, H. 1946. Iridacées. In H. Humbert, *Flore de Madagascar et des Comores* 45: 1–41. Impremerie Officielle, Tananarive.

REEVES, G., CHASE, M.W., GOLDBLATT, P., RUDALL, P.J., FAY, M.F., COX, A.V., LEJEUNE, B. & SOUZA-CHIES, T. 2001. Molecular systematics of Iridaceae: evidence from four plastid DNA regions. *American Journal of Botany* 88: 2074–2087.

SCHLÜTER, T. 2006. *Geological atlas of Africa*. Springer, Berlin.

P. GOLDBLATT* and J.C. MANNING**

---

* Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166-0299, USA. E-mail: peter.goldblatt@mobot.org.

** Compton Herbarium, South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, 7735 Cape Town. E-mail: j.manning@sanbi.org.za.

MS. received: 2010-02-05.

LYCOPERDACEAE–GASTEROMYCETES

TAXONOMIC AND NOMENCLATURAL NOTES ON BOTTOMLEY'S 'DOUBTFUL, UNKNOWN AND INSUFFICIENTLY DESCRIBED' SPECIES OF *LYCOPERDON*

INTRODUCTION

In her catalogue of South African Gasteromycetes, Bottomley (1948) listed nine species of *Lycoperdon* Pers.: Pers. as 'doubtful, unknown and insufficiently described'. During a recent taxonomic revision of the related genus *Calvatia* Fr. in southern Africa (Coetzee 2006), the opportunity arose to study the type material and more recent literature pertaining to most of these 'doubtful' members of *Lycoperdon*. Of the nine species in Bottomley's list, five could be indentified to species and two to at least generic level. The identities of only two entries remain completely unresolved.

As in our previous paper on Bottomley's Gasteromycetes (Coetzee *et al.* 1997), the order of arrangement of the taxa enumerated below follows Bottomley (1948). Author citations have, however, been abbreviated in accordance with Brummitt & Powell (1992). The number in square brackets at the end of each heading refers to the relevant page number in Bottomley (1948) and it is followed by an indication of the identity of the particular taxon in as far as we could clarify it.

With the exception of the type of *Lycoperdon capense* Fr., which was received on loan from UPS, all other type specimens were examined macro- and microscopically during two visits to the mycological herbarium of the Royal Botanic Gardens at Kew. Glebal and peridial fragments of all specimens were mounted in clear Amann's lactophenol and Amann's lactophenol with aniline blue and observed under an Olympus CHK light microscope at K (brightfield only) and a Reichert-Jung Polyvar instrument in the senior author's own laboratory (brightfield, interference contrast, phase contrast and dark-field).

ANNOTATED LIST OF TAXA

1. Lycoperdon asperrimum *Welw. & Curr.* in Transactions of the Linnean Society of London 26: 289 (1868). [562; **Vascellum asperrimum** *(Welw. & Curr.) Kreisel*]

TYPE.—Angola, Mossamedes Dist., 'in dumetosis arenosis ad marginem de Lagoa de Giraul, locis subsalsis', *Welwitsch 142*, July 1859 (K, holo.!).

After having studied the types of both *Lycoperdon asperrimum* and *L. angulatum* Dissing & M.Lange, Demoulin & Dring (1975) concluded that *L. angulatum* was a later synonym of *L. asperrimum*. Based on the original description of *L. angulatum*, as well as an examination of both the *L. asperrimum* holotype and an 'ex type' specimen of *L. angulatum* at K, the current authors are not fully convinced of this synonymy, an opinion based primarily on capillitial differences. In capillitial morphology the *L. angulatum* material at K differs from the original description of that fungus in Dissing & Lange (1962) by virtue of its considerably smaller diameter and apparent lack of septa. Furthermore, the original *L. angulatum* description (capillitium pale brownish violet, septate, branched, pitted) does not agree with the *L. asperrimum* holotype which has unbranched, non-pitted capillitium as described below. Although there is no evidence in the folder at K or in his own paper of having examined any type material, Kreisel (1993) concurred with Demoulin & Dring (1975) regarding the synonymy of the two species. He treated *L. asperrimum* in the genus *Vascellum* F.Šmarda as [*Vascellum asperrimum* (Welw. & Curr.) Kreisel], we assume on account of the distinct diaphragm as described in Dissing & Lange (1962). Visually the diaphragm in the *L. asperrimum* holotype is not well defined but its presence can be detected when a needle is drawn upwards across the subglebal tissue as described in Homrich & Wright (1988). True capillitium is present but sparse, thin-walled, aseptate, unbranched and without perforations under the light microscope. On the basis of our observations we have little reason to dispute Kreisel's (1993) appointment of *L. asperrimum* to the genus *Vascellum*. Its purported synonymy with *L. angulatum*, however, needs further investigation, although it will not affect the name or status of *V. asperrimum*.

Note: Ponce de León (1970) also transferred *L. angulatum* to the genus *Vascellum*, as *Vascellum angulatum* (Dissing & M.Lange) P.Ponce de León.

2. Lycoperdon bicolor *Welw. & Curr.* in Transactions of the Linnean Society of London 26: 290 (1868). [562; **identity unresolved**]

TYPE.—Angola, Huilla Dist. between Lopollo and Empalanea, 'in pascuis humidiusculis silvaticis, 3800–5500 ped. elevat.', *Welwitsch 146*, May 1860 (K, holo.!).

Demoulin (1971) was of the opinion that *Lycoperdon bicolor* probably represented a good species, to which Demoulin & Dring (1975) also assigned a collection from Rwanda. According to the latter authors, the Rwanda material had a well-developed diaphragm, on account of which Kreisel (1993) transferred this fungus to the genus *Vascellum* as *V. bicolor* (Welw. & Curr.) Kreisel. The type specimen at K consists of an intact specimen from which the presence or absence of a diaphragm is not readily observable. If the material from Rwanda is not conspecific with the original collection from Angola, a possibility acknowledged by Demoulin & Dring (1975), then Kreisel's treatment of *Lycoperdon bicolor* as a *Vascellum* would need to be reassessed. Detailed re-examinations of both collections are required to confirm or refute both their conspecificity and Kreisel's designation.

3. Lycoperdon capense *Cooke & Massee* in Massee in Journal of the Royal Microscopical Society 1887: 714, t. 12, figs 4, 5 (1887). [563; **identity partly resolved**: not a *Lycoperdon* or *Bovista*, most probably a **Calvatia** *Fr.*]

TYPE.—Cape of Good Hope, on the ground. [holo.†(?); t. 12, fig. 4, 5 in Massee (1887)!, lecto., here designated].

Note: neither Bottomley (1948) nor Demoulin (1971) was able to locate the type and a recent search by the first author at K also failed to find it. The type is therefore assumed to be missing. The figures in Massee (1887) thus become the obligatory lectotype.

The compact sterile base (Massee 1887) excludes this species from *Lycoperdon*, the lack of a diaphragm separates it from *Vascellum* and the unbranched capillitium of uniform diameter indicates that it is not a *Bovista* either. According to the original description, and on the basis of elimination of other possibilities, this is most probably a *Calvatia*, approximating *C. candida* and *C. rugosa*. Massee's (1887) illustration is of little diagnostic value, however, and in the absence of the original material we are reluctant to formally assign it to that genus. Should the type be found, however, and it proves to be a good species, a name change will be inevitable since *L. capense* Cooke & Massee is a later homonym of *L. capense* Fr.

4. Lycoperdon capense *Fr.,* J.A. Wahlbergii Fungi natalenses, adjectis quibusdam capensibus: 30 (1848). [563; mixed collection: **Bovista capensis** *(Fr.) J.C.Coetzee & A.E.van Wyk* and **Calvatia**, sp. nov.]

TYPE.—South Africa, Promontorium Bonae Spei (Cape of Good Hope), Uitenhage, *Zeyher 106a.* (Herb. E. Fries in UPS!, lecto.).

Lycoperdon capense Fr. is known from the type collection only, but as has been reported elsewhere (Kreisel 1967; Coetzee & Van Wyk 2005), Zeyher's original material (*Zeyher 106 sub herb. E. Fries* at UPS) represents a mixed collection, the two elements of which have been separated and which are filed in separate folders in UPS as *Zeyher 106a* and *106b* respectively. Kreisel (1967) assigned *Zeyher 106a* to *Bovista promontorii* Kreisel, but Coetzee & Van Wyk (2005) selected this component of *Zeyher 106* as lectotype for *Lycoperdon capense* Fr., which actually is a *Bovista*, correctly named *B. capensis* (Fr.) J.C.Coetzee & A.E.van Wyk.

Zeyher 106b represents an undescribed, but not at all uncommon, South African species belonging to *Calvatia* sect. *Macrocalvatia* Kreisel *sensu* Coetzee & Van Wyk (2003).

The specimen in the *Lycoperdon capense* Fr. type folder at K, also '*Zeyher 106*' from Uitenhage, lacking a true capillitium and opening with a pore, is not a *Calvatia* and is here tentatively assigned to *Vascellum*.

Note: as explained elsewhere (Coetzee & Van Wyk 2005; Glen & Germishuizen 2010) the numbers on Zeyher specimens can be a source of confusion. In some cases it may represent Zeyher's collecting number but, more often, it refers to the collecting locality. Therefore, specimens from the same locality may all carry the same number, yet belong to different gatherings, as seems to be the case with *Zeyher 106*. Locality 106 is listed in Glen & Germishuizen (2010) as 'Uitenhage, Zuureberg, 2–3000''. [In addition to the specimens already mentioned, *Zeyher 106* also consists of a fourth component, studied by Demoulin (1972) at K, on which Berkeley (1843) based the genus *Scoleciocarpus* (= *Arachnion* Schwein.) and species *Scoleciocarpus tener* Berk.]

5. Lycoperdon curreyi *Massee* in Journal of the Royal Microscopical Society 1887: 706 (1887). [563; **Calvatia cyathiformis** *(Bosc) Morgan*]

Replaced synonym: *Lycoperdon radicatum* Welw. & Curr. in Transactions of the Linnean Society of London 26: 289 (1868), non Durieu & Mont. in Durieu de Maisonneuve: 383 (1848).

TYPE.—Angola, Dist. Loanda, near Penedo, *Welwitsch 116.* (K, holo.!).

Massee (1887) established this new name for *Lycoperdon radicatum* Welw. & Curr. because the latter was a later homonym of *L. radicatum* Durieu & Mont. After microscopic examination of the holotype at K, however, the current authors are left with no doubt that, on the basis of glebal and endoperidial similarity in particular, *Lycoperdon curreyi* Massee is just another synonym of *Calvatia cyathiformis* (Bosc) Morgan. Apart from the type material, Bottomley (1948) cites six additional collections of *L. curreyi* from South Africa. At least two of these [*MacOwan 1004* (*PREM22062*) and *MacOwan 1009* (*PREM22061*)] do not belong to *C. cyathiformis*, however, but to yet another new South African *Calvatia* species to be described elsewhere.

6. Lycoperdon gardneri *Berk.* in Berkeley & Broome in Journal of the Linnean Society, Botany. London 14: 79 (1873). [564; **Calvatia pyriformis** *(Lév.) Kreisel*]

TYPE.—Sri Lanka, Peradeniya, in shady places, *Gardner 9*, May 1844. (K, holo.!).

On the basis particularly of its very characteristic ornamented oval spores, there can be no doubt that *Lycoperdon gardneri* Berk. is merely a synonym of *Calvatia pyriformis* (Lév.) Kreisel, as had been concluded also by Kreisel (1992, 1994).

Bottomley (1948) listed this fungus on the strength of Massee's (1887) statement that it occurred in South Africa. What that statement was based on remains a mystery, however, and a search at K provided no evidence in support of the purported occurrence of this fungus in South Africa. The *Calvatia gardneri* file at K contains only three relatively recent southern African collections, one each from South Africa, Zambia and Malawi. Not one of them is *Calvatia pyriformis*, however, and the occurrence of this fungus in South Africa therefore remains unconfirmed.

7. Lycoperdon glabellum *Peck* in Report (Annual) of the New York State Museum of Natural History by the Regents of the University of the State of New York 31: 39 (1878). [564; **identity unresolved**]

TYPE.—USA, New York State, Rensselaer County, North Greenbush, on ground in copses and in pine woods. *C.H. Peck note no. 710*, autumn. [NYS, lecto., vide Demoulin (1979)].

According to Demoulin (1979), *Lycoperdon glabellum* is probably a synonym of *L. molle* Pers.: Pers. The single record from South Africa, cited in Kalchbrenner (1882) and Bottomley (1948), could not be found at PREM or K, however, and the status of the South African '*Lycoperdon glabellum*' therefore remains unresolved.

8. Lycoperdon laetum *Berk.* in Hooker's Journal of Botany and Kew Garden Miscellany 2: 519 (1843). [565; **Vascellum** sp.]

TYPE.—South Africa, Uitenhage, on the ground, *Zeyher 103*, October. (K, holo.!).

According to Demoulin (1971) this is a *Calvatia*. A re-examination of the type revealed the presence of paracapillitium and the absence of capillitium, however, and it must therefore be excluded from *Calvatia* and *Lycoperdon*. It is here considered a member of the genus *Vascellum*, the species determination of which is yet to be resolved.

9. Lycoperdon natalense *Fr.*, J.A. Wahlbergii Fungi natalenses, adjectis quibusdam capensibus: 30 (1848). [565; **Calvatia cyathiformis** *(Bosc) Morgan*]

TYPE.—South Africa, Natal, *J.A. Wahlberg s.n.* [holo.†(?), not in UPS (Dr S. Ryman pers. comm., UPS)].

Although Demoulin (1971) considered this to be a *Calvatia*, he regarded it as 'difficult' to identify to species. The original description of *L. natalense* is cryptic indeed: '*Altera e Terra Natal* L. caelato *affinis, ab hoc differt sporis vinosis l. purpurascentipallidus*' [= akin to *Lycoperdon cealatum* (= *Calvatia utriformis*) but differing in respect of its vinaceous or pale purplish spores]. Although the original material does not seem to exist anymore, the description is unambiguous. If it was similar to *Calvatia utriformis*, as claimed by Fries (1848), it must have possessed a prominent sterile base, and there is only one species in South Africa like that with purple spores, namely *Calvatia cyathiformis*. The authors are therefore quite convinced that *Lycoperdon natalense* Fr., which is known from the original description (Fries 1848) only, should be reduced to synonymy under *Calvatia cyathiformis*.

ACKNOWLEDGEMENTS

The senior author wishes to express his gratitude towards Dr D.N. Pegler (retired) and Dr B.M. Spooner of the Mycological Herbarium at Kew for their hospitality and friendly assistance during study visits to that institution. We are also indebted to the director of UPS for the loan of the type material of *Lycoperdon capense* Fr. The assistance of Dr S. Ryman of the same institution is acknowledged with gratitude, as is a research grant from the Cape Peninsula University of Technology.

REFERENCES

BERKELEY, M.J. 1843. Enumeration of fungi, collected by Herr Zeyher in Uitenhage. *Hooker's Journal of Botany and Kew Garden Miscellany* 2: 507–524, t. XXII.

BERKELEY, M.J. & BROOME, C.E. 1873. Enumeration of the fungi of Ceylon. *Journal of the Linnean Society, Botany, London.* 14: 29–140.

BOTTOMLEY, A.M. 1948. Gasteromycetes of South Africa. *Bothalia* 4: 473–810.

BRUMMITT, R.K. & POWELL, C.E. 1992. *Authors of plant names*. Royal Botanic Gardens, Kew.

COETZEE, J.C. 2006. *Contributions towards a new classification of* Calvatia *Fr. (Lycoperdaceae) in southern Africa.* Ph.D. thesis, University of Pretoria.

COETZEE, J.C., EICKER, A. & VAN WYK, A.E. 1997. Nomenclatural notes on the Phallales, Sclerodermatales, Lycoperdales and Nidulariales (Gasteromycetes), sensu Bottomley in South Africa. *Bothalia* 27: 117–123.

COETZEE, J.C. & VAN WYK, A.E. 2003. *Calvatia* sect. *Macrocalvatia* redefined and a new combination in the genus *Calvatia*. *Bothalia* 33: 156–158.

COETZEE, J.C. & VAN WYK, A.E. 2005. *Bovista capensis*, the correct name for *Bovista promontorii*. *Bothalia* 35: 74, 75.

DEMOULIN, V. 1971. *Le genre* Lycoperdon *en Europe et en Amérique du Nord. Étude taxonomique et phytogéographique.* Doctoral thesis, Université de Liège.

DEMOULIN, V. 1972. Observations sur le genre *Arachnion* Schw. (Gasteromycetes). *Nova Hedwigia* 21: 641–655.

DEMOULIN, V. 1979. The typification of *Lycoperdon* described by Peck and Morgan. *Beihefte zur Sydowia* 8: 139–151 & 3 tt.

DEMOULIN, V. & DRING, D.M. 1975. Gasteromycetes of Kivu (Zaïre), Rwanda and Burundi. *Bulletin du Jardin Botanique National de Belgique* 45: 339–372.

DISSING, H. & LANGE, M. 1962. Gasteromycetes of Congo. *Bulletin du Jardin Botanique de l'État* 32: 325–416.

DURIEU DE MAISONNEUVE, M.C. 1848. *Exploration scientifique de l'Algérie*, vol. 1, part 10. Imprimerie royale, Paris.

FRIES, E.M. 1848. *J.A. Wahlbergii Fungi natalenses, adjectis quibusdam capensibus.* Norstedt, Stockholm.

GLEN, H.F. & GERMISHUIZEN, G. 2010. Botanical exploration of southern Africa, edn 2. *Strelitzia* 26. South African National Biodiversity Institute, Pretoria.

HOMRICH, M.H. & WRIGHT, J.E. 1988. South American Gasteromycetes. II. The genus *Vascellum*. *Canadian Journal of Botany* 66: 1285–1307.

KALCHBRENNER, C. 1882. Fungi Macowaniani. *Grevillea* 10: 104–109.

KREISEL, H. 1967. Taxonomisch-Pflanzengeographische Monographie der Gattung *Bovista*. *Beihefte zur Nova Hedwigia* 25: 1–244.

KREISEL, H. 1992. An emendation and preliminary survey of the genus *Calvatia* (Gasteromycetidae). *Persoonia* 14: 431–439.

KREISEL, H. 1993. A key to *Vascellum* (Gasteromycetidae) with some floristic notes. *Blyttia* 51: 125–129.

KREISEL, H. 1994. Studies in the *Calvatia* complex (Basidiomycetes) 2. *Feddes Repertorium* 105: 369–376.

MASSEE, G. 1887. A monograph of the genus *Lycoperdon* (Tournef.) Fr. *Journal of the Royal Microscopical Society* 1887: 701–727, tt. 12, 13.

PECK, C.H. 1878. Report of the botanist. *Report (Annual) of the New York State Museum of Natural History by the Regents of the University of the State of New York* 31: 17–72.

PONCE DE LEÓN, P. 1970. Revision of the genus *Vascellum* (Lycoperdaceae). *Fieldiana: Botany* 32: 109–125.

WELWITSCH, F. & CURREY, F. 1868. Fungi angolensis. A description of the fungi collected by Dr Friedrich Welwitsch in Angola during the years 1850–1861. *Transactions of the Linnean Society of London* 26: 279–294, tt. 17–20.

J.C. COETZEE* and A.E. VAN WYK**

---

* Department of Horticultural Sciences, Bellville Campus, Cape Peninsula University of Technology, P.O. Box 1906, 7535 Bellville. E-mail: coetzeej@cput.ac.za.

** H.G.W.J. Schweickerdt Herbarium, Department of Plant Science, University of Pretoria, 0002 Pretoria. E-mail: braam.vanwyk@up.ac.za.

MS. received: 2009-09-18.

COLCHICACEAE

COLCHICUM ALBOFENESTRATUM, A NEW SPECIES FROM NAMAQUALAND, SOUTH AFRICA

Colchicum L. was until recently regarded as a strictly northern hemisphere genus comprising ± 90 species of acaulescent, often hysteranthous-leaved geophytes. Based on the results of the molecular studies in Colchicaceae by Vinnersten & Manning (2007), the genus was redefined by Manning *et al.* (2007) to include all the species of *Androcymbium* Willd., ± 50 of which occur in southern Africa with a further few species in the Canary Islands, North Africa and the Mediterranean. As presently circumscribed, *Colchicum* is found in Africa, Europe and Asia and encompasses ± 150 species. The enlarged genus is well defined by its mostly reduced or absent stem, a congested spike of erect, sessile or subsessile, bracteate flowers with specialized androecial nectaries situated at the base of the filaments (secondarily lost in some species), by unusual 2–4-porate pollen, and by the occurrence of idioblasts containing sulphur-mucopolysaccharides in some or all parts of the plant.

Among the southern African species of *Colchicum*, Müller-Doblies & Müller-Doblies (1984, 1990, 1998, 2002) added 23 new species and three new subspecies to the traditionally recognised *Androcymbium*. Pedrola-Monfort *et al.* (1999a, b) contributed a further two new species and one new subspecies, and Manning & Goldblatt (2001) described one more new species. During the compilation of an account of the monocotyledonous flora of the Succulent Karoo region, South Africa (Snijman *et al.* 2008) it became evident that three collections in the Compton Herbarium (NBG) represent a very distinctive species from Namaqualand that still remains unnamed. First collected in 1986 by Dr E.G.H. Oliver, a well-known Cape botanist, this new species is recognised by its crispulate leaf margins and the white and green tessellated bracts, and is described as *Colchicum albofenestratum*.

Colchicum albofenestratum *J.C.Manning & Snijman*, sp. nov.

Plantae acaulescentes, cormo (8–)10–23 mm diam. Folia 3, disticha; inferioribus 2 lanceolatis vel ovatis, 20–45 × 6–30(–45) mm, patentibus, marginibus undulatis vel crispulatis, hyalinis, cartilagineis, plerumque laevibus; supremo suberecto vel erecto, late ovato vel oblongo, acutato vel obtusato, carinato, 20–45 × 12–40 mm, nervatura viridi, intervenio albo, margine plano vel leviter undulato, laevi, carina hyalina et cartilaginea, laevi vel papillata; bracteis late ovato-oblongibus vel obovatibus, colore folium supremum simulantibus. Flores 1 vel 2, sessiles; perianthio unguiculato, ± 12 mm longo, ungue 5–6 × 1.5–2.0 mm; limbo auriculato-cucullato, 7 × 3 mm. Stamina exserta; filamentis curvis, 7 mm longis, limbum tepali ± aequantibus; antheris oblongis, 5.5–6.0 mm longis. Ovarium subglobosum, ± 4 mm longum; stylo ± 7 mm longo.

TYPE.—Western Cape: 3118 (Vanrhynsdorp): Knersvlakte, Kwaggaskop, clay flats near railway line, (–BC), 20 August 1986, *Snijman 1064* (NBG, holo.).

Acaulescent, cormous geophyte. *Corm* 40–55 mm deep, ovoid, (8–)10–23 mm diam., with crescent-shaped basal crest, tunics brown, coriaceous. *Leaves* 3, distichous, amplexicaul; lower 2 spreading or prostrate, lanceolate to ovate, 20–45 × 6–30(–45) mm, apiculate, margin closely undulate or crispulate, hyaline, cartilaginous, smooth or rarely minutely ciliate basally; uppermost suberect or erect, thin-textured, broadly ovate-oblong, 20–45 × 12–40 mm, acute or obtuse, keeled, conspicuously tessellated, white with green rectangular veining, the green coloration usually coalescing and becoming solid distally, white windows collapsing when dry and thus ± excavated, margin plane or slightly undulate, smooth, keel hyaline and cartilaginous, smooth or papillate; bracts broadly ovate-oblong to obovate, resembling upper leaf in texture and coloration but tessellated throughout, lowermost slightly smaller than uppermost leaf, 15–40 mm long. *Flowers* 1 or 2, sessile; perianth ± 12 mm long, clawed, tepal claw 5–6 × 1.5–2.0 mm, tepal limb erect, lanceolate, cucullate, basally auriculate, 7 × 3(–6) mm. *Stamens* exserted; filaments curved, shorter to ± as long as tepal limb, 4–7 mm long, apparently green; nectary globular, ± 1 mm diam., apparently darkly coloured; anthers oblong, 5.5–6.0 mm long. *Ovary* subglobose, ± 4 mm long; styloids erect, apically recurved, ± 7 mm long; stigmas apical, punctiform. *Flowering time*: mid to late July, rarely early August. Figure 6.

Distribution and ecology: *Colchicum albofenestratum* is currently known from just two localities on the Knersvlakte, a broad undulating plain in southern Namaqualand that straddles the Northern and Western Cape Provinces, South Africa. In the northeastern Knersvlakte, the species has been recorded from the lower foothills of the inland escarpment, ± 20 km SW of Loeriesfontein, Northern Cape, and in the southwest it is known from an area just north of the Soutrivier near the Farm Rooiberg, Western Cape (Figure 7). The single northeastern Knersvlakte plant examined has the tepals unusually broadened at the base, ± 5 mm wide, forming a conspicuous nectar cup. Unfortunately the apices have been eaten off and it is also not possible to determine how consistent these broad tepals are within the population. In all other respects it matches the Rooiberg plants exactly. Never abundant, *C. albofenestratum* grows in stony, loamy sand among sparse, low, succulent shrubs in a climate marked by hot, dry summers and mild, rainy winters. Like most southern African *Colchicum* species from the winter rainfall region, *C. albofenestratum* flowers in winter, usually from mid to late July into August.

Working within the concept of the genus *Androcymbium*, Müller-Doblies & Müller-Doblies (2002) recognised several floral features as putative adaptations to pollination systems. From the form and size of the tepals, the length of the anthers, and the position and colouring of the androecial nectaries, they inferred the existence of melittophilous, myophilous and mammal pollination syndromes in several southern African species. In addition, Manning *et al.* (2007) hypothesized that the coloured or contrastingly textured bracts that characterize several *Colchicum* species with geoflorous inflorescences are

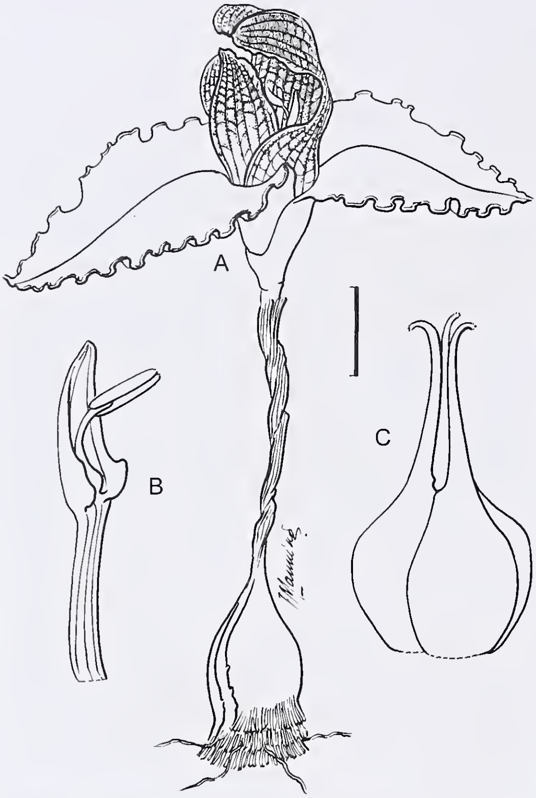


FIGURE 6.—*Colchicum albofenestratum*, *Snijman 2349* (PRE). A, plant; B, detached tepal; C, developing capsule. Scale bar: A, 10 mm; B, C, 5 mm. Artist: J.C. Manning.

possible adaptations to rodent pollination. The importance of these floral traits has since been confirmed by Kleizen *et al.* (2008) who found that *Colchicum scabromarginatum* (Schltr. & K.Krause) J.C.Manning & Vinnersten appears to depend exclusively on rodents for fertilization, that *C. coloratum* J.C.Manning & Vinnersten subsp. *coloratum* attracts both rodents and birds, and that *C. hantamense* Engl. is honey-bee pollinated. Based on these findings it seems likely that *C. albofenestratum*, with its broad, thin-textured, white and green tessellated bracts and apparently dark nectar, constitutes a further member of the guild of rodent-pollinated geophytes that is now known from the Succulent Karoo.

Diagnosis and relationships: *Colchicum albofenestratum* is distinguished by its markedly heterophyllous leaves, with the lower two leaves opposite, spreading or prostate, crispulate-edged and mostly aciliate, and the upper leaf and bracts broadly ovate-oblong and attractively patterned by vertical rows of small, thin-textured, depressed, white interstices between green, longitudinal and cross-veins. The solitary or paired flowers have tepals with a limb ± 7 mm long and almost equal to the filaments in length, large anthers 5.5–6.0 mm long, and apparently dark androecial nectaries.

The tessellated bracts and uppermost leaf of *C. albofenestratum* are unique in the genus and are approached only in *C. crispum* (Schinz) J.C.Manning & Vinnersten, in which the uppermost leaf is white with green veins in the lower half and the bracts are entirely white or flushed green apically. *Colchicum crispum* is the only other species known to have crispulate leaf margins but the margins in this species are copiously and coarsely ciliate, and the filaments are much exserted from the tepal limbs.

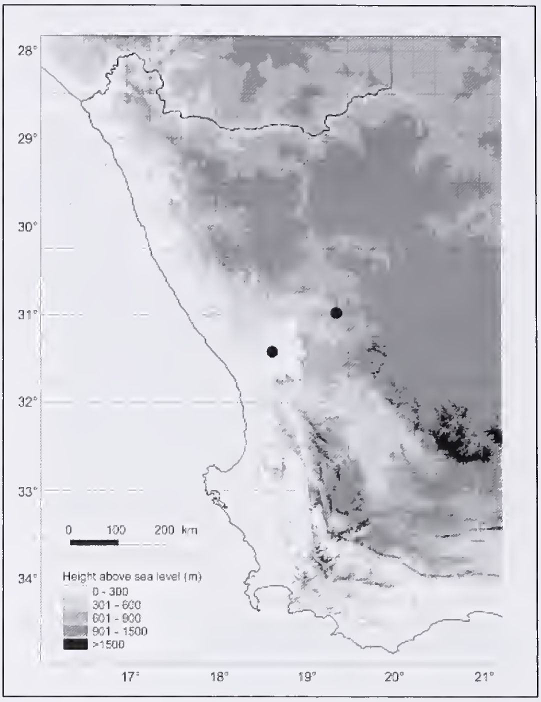


FIGURE 7.—Known distribution of *Colchicum albofenestratum*.

Species relationships within *Colchicum* remain incompletely understood. The detailed infrageneric classification of *Androcymbium* proposed by Müller-Doblies & Müller-Doblies (2002), based on morphology that primarily reflects pollination syndromes, has not received support from the molecular studies by Manning *et al.* 2007, which show that section *Androcymbium* is polyphyletic and that the attractively coloured or enlarged upper leaf and bracts appear to have evolved independently in at least two clades in section *Androcymbium*. We are unable to speculate on the possible relationships of *C. albofenestratum* at present.

Other specimens seen

NORTHERN CAPE.—3019 (Loeriesfontein): Kamdaniekop, slopes SW of turnoff to Kliprand, (–CD), 12 July 1986, *Oliver 8844* (NBG).

WESTERN CAPE.—3118 (Vanrhynsdorp): Knersvlakte, Farm Rooiberg, sand at base of dolomite outcrop, (–BC), 22 July 2005, *Snijman 2022* (NBG); 31 August 2009 (fruiting), *Snijman 2349* (PRE).

ACKNOWLEDGMENTS

The Department of Tourism, Environment and Conservation in Northern Cape, the Western Cape Nature

Conservation Board, and Mr Buys Wiese are thanked for permits and permission to collect specimens on the Knersvlakte. Colin Paterson-Jones kindly assisted in the field and Hester Steyn prepared the map.

REFERENCES

KLEIZEN, C., MIDGELEY, J. & JOHNSON, S.D. 2008. Pollination systems of *Colchicum* (Colchicaceae) in southern Africa: evidence for rodent pollination. *Annals of Botany* 102: 747–755.

MANNING, J.C. & GOLDBLATT, P. 2001. A remarkable new species of *Androcymbium* from Northern Cape, South Africa. *Bothalia* 31: 203–205.

MANNING, J.C., FOREST, F. & VINNERSTEN, A. 2007. The genus *Colchicum* L. redefined to include *Androcymbium* Willd. based on molecular evidence. *Taxon* 56: 872–882.

MÜLLER-DOBLIES, U. & MÜLLER-DOBLIES, D. 1984. Zur Kenntnis der Gattung *Androcymbium* (Colchicaceae) im südlichen Afrika: Zwei Synonyma und fünf neue Arten. *Willdenowia* 14: 179–197.

MÜLLER-DOBLIES, U. & MÜLLER-DOBLIES, D. 1990. Zur Kenntnis der Gattung *Androcymbium* (Colchicaceae) im südlichen Afrika: 2. *Androcymbium exiguum* hat doch Artwert. *Willdenowia* 19: 453–470.

MÜLLER-DOBLIES, U. & MÜLLER-DOBLIES, D. 1998. De Liliifloris notulae. 6. De decuria prima specierum novarum generis *Androcymbium* sect. Androcymbium (Colchicaceae) in Africa Australis *s.l. Feddes Repertorium* 109: 551–572.

MÜLLER-DOBLIES, U. & MÜLLER-DOBLIES, D. 2002. De Liliifloris notulae. 7. De decuria altera specierum novarum generis *Androcymbium* (Colchicaceae) in Africa Australi *s.l. Feddes Repertorium* 113: 545–599.

PEDROLA-MONFORT, J., MEMBRIVES, N., MONTSERRAT, J.M. & CAUJAPÉ-CASTELLS, J. 1999a. A new species from western South Africa: *Androcymbium huntleyi* (Colchicaceae). *Fontqueria* 53: 1,2.

PEDROLA-MONFORT, J., MEMBRIVES, N. & MONTSERRAT, J.M. 1999b. Two new *Androcymbium* (Colchicaceae) from western South Africa. *Fontqueria* 54: 7–9.

SNIJMAN, D.A., MANNING, J.C., GOLDBLATT, P., FISH, L., DUNCAN, G.D., ARCHER, C., ROUX, J.P., KURZWEIL, H., LINDER, H.P., VERBOOM, G.A., KLOPPER, R.R. & SMITH, G.F. 2008-09. *Monocotyledons, ferns and quillworts of the Namaqualand-Namib Succulent Karoo, Tanqua-southern Great Karoo and Western Mountain Karoo, southern Africa*. website: http://www.sanbi.org/frames/posafram.htm/.

VINNERSTEN, A. & MANNING, J.C. 2007. A new classification of Colchicaceae. *Taxon* 56: 171–178.

D.A. SNIJMAN* and J.C. MANNING*

---

* Compton Herbarium, South African National Biodiversity Institute, Private Bag X7, 7735 Cape Town.

MS. received: 2009-09-16.

OXALIDACEAE

REDISCOVERY AND PHYLOGENETIC POSITION OF THE RARE *OXALIS PURPURATA*

The most recent major taxonomic work on southern African *Oxalis* L. (Salter 1944) features a number of poorly known taxa collected from only one or two localities. A significant fraction of these species are described and only known from extremely poor data. Some, such as *Oxalis incerta* R.Knuth and *O. linoides* R.Knuth, are described from incomplete herbarium specimens that often lack bulbs or even flowers. Other taxa lack locality data, or appear to be merely aberrant forms of good species. Although these species were upheld by Salter (1944), he retained these taxa only in the interests of completeness, and expressed his gravest doubt about the validity of several.

Recent palynological (Dreyer 1996) and DNA sequence-based work (Oberlander *et al.* 2004, 2009) on the genus has clarified the status of a number of these taxa. In some of these cases a more definite answer to the uncertain status of these poorly known species was achieved. For example, Dreyer & Van Wyk (1996) placed *Oxalis henrici* F.Bolus in synonymy under the more widespread *O. engleriana* Schltr. on the basis of a unique pollen type shared by both species. In other instances, new species such as *O. hygrophila* Dreyer (Kumwenda *et al.* 2004) and *O. saltusbelli* Dreyer & Roets (Dreyer *et al.* 2009b), have been described that have clarified relationships between morphologically dissimilar taxa. Also, a phylogenetic scheme based on DNA data is in the process of being constructed for the entire southern African clade of *Oxalis*, of which some preliminary phylogenies have been presented in the literature (Oberlander *et al.* 2004, 2009). A number of poorly known taxa were not relocated after eight years of intensive collection, and could not be validated and/or systematically placed with any certainty on the basis of DNA data. This was not a problem for species that share putative macro-morphological or palynological synapomorphies, which would allow at least a tentative placement. For some poorly known taxa, however, the paucity of even this knowledge meant that little could be changed with regards to their highly dubious taxonomic status.

Oxalis purpurata Jacq. represents one of these poorly known taxa. To our knowledge, this species has only been collected twice. Apart from the original description by Jacquin (1798), Salter (1940) found a population of this species growing amongst rocks in Vanrhyn's Pass, now on the border between the Northern and Western Cape Provinces, South Africa. Due to this poor record, this species is placed in the Rare category (Dreyer *et al.* 2009a).

Taxonomically, Salter (1940) placed the species in section *Cernuae* subsection *Purpuratae* based on the acaulescent habit, the lack of an apical beak to the bulb, the smooth nature of the bulb tunics, and the basal peduncles. This position was upheld in his later monograph on South African *Oxalis* (Salter 1944). The other two members of this subsection, *O. bowiei* Lindl. and *O. semiloba* Sond., are both summer rainfall species associated with the coastal regions of the Eastern Cape and KwaZulu-Natal. The resulting biogeographic link between these summer rainfall species and *O. purpurata* seems unlikely if the current distributions of the three species are compared. In addition, *O. purpurata* differs from both of the other taxa in not producing a contractile root and by bearing teeth on the filament bases, characters considered taxonomically important by Salter (1944).

Oxalis purpurata has not been rediscovered at Vanrhyn's Pass after several years of visiting the site, and its status at this locality is uncertain, presumed extinct. A recent scrutiny of unidentified *Oxalis* specimens in the Compton Herbarium (NBG, Cape Town, South Africa) produced a specimen of *O. purpurata* from the Oorlogskloof Nature Reserve, ± 10 km south of the Pass (*W.A.J. Pretorius 707*, *NBG181394*). This prompted more extensive searches for this species in the Nature Reserve, and in June 2008 a flowering population was discovered in a similar habitat to that described by Salter (1940). Herbarium specimens and living material (*MO1118*, *Dreyer 836*) were collected, and a leaf sample was taken for later DNA extraction and sequencing.

Due to the recent date of rediscovery, this species could not be included in large-scale phylogenetic analyses of the genus (Oberlander *et al.* 2009). However, smaller-scale analyses of the nuclear Internal Transcribed Spacer region (Genbank accession number FJ426283), following the protocols and procedures of Dreyer *et al.* (2009b), yielded a confident placement within a small clade of species with umbellate inflorescences (Parsimony bootstrap support: 99 %; Bayesian posterior probability: 1.00). This clade corresponds to a clade represented by *Oxalis pes-caprae* L. and *O. purpurascens* Salter in Oberlander *et al.* (2009), hereafter called the *O. pes-caprae* clade. Apart from well-known weedy species such as *O. pes-caprae*, this clade includes taxa from Namibia (e.g. *O. purpurascens* and its allies), Namaqualand (e.g. *O. haedulipes* Salter and its allies) and the western Cape Floristic Region (e.g. *O. compressa* L.f.). The only other sampled member of subsection *Purpuratae*, *Oxalis bowiei*, is not closely related to the *O. pes-caprae* clade, but instead is closely related to other summer rainfall taxa such as *O. tragopoda* Salter and *O. stellata* Eckl. & Zeyh. The extremely close morphological resemblance between *O. bowiei* and *O. semiloba*, and provisional DNA data (K.C. Oberlander pers. comm.), also makes the latter species a very unlikely relative of *O. purpurata*.

The presence of umbellate inflorescences and the almost succulent nature of *Oxalis purpurata* are in agreement with many other members of the *O. pes-caprae* clade. It does differ from all other members of the clade in bearing pale lilac (instead of yellow or white) flowers, and no contractile root. However, neither of these character states are shared by the two summer rainfall taxa either. Most other morphological (i.e. teeth present on the filaments, seven or more ovules per carpel, glabrous corolla) and palynological (finely reticulate tectum; Dreyer 1996) features are congruent with a placement in the *O. pes-caprae* clade. Given the congruent DNA and morphological data, we consider *O. purpurata* to be unrelated to the summer rainfall species of subsection *Purpuratae*. Instead, a position within the *O. pes-caprae* clade as a close relative of *O. pes-caprae*, *O. compressa*, *O. copiosa* Bolus f. and *O. haedulipes* is therefore strongly supported.

ACKNOWLEDGEMENT

This research was supported by an NRF grant (GUN no. 2053585) awarded to L. Dreyer.

REFERENCES

DREYER, L.L. 1996. *A palynological review of* Oxalis *(Oxalidaceae) in southern Africa*. Ph.D. (Botany) thesis, University of Pretoria.

DREYER, L.L., OBERLANDER, K.C. & PILLAY, D. 2009a. *Oxalis purpurata*. In D. Raimondo, L. von Staden, W. Foden, J.E. Victor, N.A. Helme, R.C. Turner, D.A. Kamundi & P.A. Manyama, Red List of South African plants 2009. *Strelitzia* 25: 451. South African National Biodiversity Institute, Pretoria.

DREYER, L.L., ROETS, F. & OBERLANDER, K.C. 2009b. *Oxalis saltusbelli*: a new *Oxalis* (Oxalidaceae) species from the Oorlogskloof Nature Reserve, Nieuwoudtville, South Africa. *South African Journal of Botany* 75: 110–116.

DREYER, L.L. & VAN WYK, A.E. 1996. Taxonomic delimitation of *Oxalis engleriana*. *Bothalia* 28: 65.

JACQUIN, N.J. 1798. Oxalis *Monographia, Iconibus Illustrata* III 57: 356. Wappler, Vienna.

KUMWENDA, M., DREYER, L.L. & MARAIS, E.M. 2004. A taxonomic reassessment of the varieties of *Oxalis minuta* (Oxalidaceae) and the change of *O. minuta* var. *callosa* to specific rank as *O. hygrophila*. *South African Journal of Botany* 70: 259–264.

OBERLANDER, K.C., DREYER, L.L., BELLSTEDT, D.U. & REEVES, G. 2004. Congruence of *trn*L-F and palynological data sets in the southern African *Oxalis* L. section *Angustatae* subsection *Lineares*. *Taxon* 53: 977–985.

OBERLANDER, K.C., EMSHWILLER, E., BELLSTEDT, D.U. & DREYER, L.L. 2009. A model of bulb evolution in the eudicot genus *Oxalis* L. (Oxalidaceae). *Molecular Phylogenetics and Evolution* 51: 54–63.

SALTER, T.M. 1940. Some notes on the South African *Oxalis* of the section *Cernuae*. *Journal of South African Botany* VI: 15.

SALTER, T.M. 1944. The genus *Oxalis* in South Africa: a taxonomic revision. *Journal of South African Botany*, Suppl. vol. 1: 1–355.

K.C. OBERLANDER*†, L. L. DREYER** and F. ROETS*

---

* Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, 7602 Matieland, Stellenbosch.

** Department of Botany and Zoology, Stellenbosch University, Private Bag X1, 7602 Matieland, Stellenbosch.

† corresponding author. E-mail: kco@sun.ac.za.

MS. received: 2009-09-28.

EUPHORBIACEAE

A NEW NAME FOR *EUPHORBIA CHAMAECLADA* FROM ANGOLA

The name *Euphorbia chamaeclada* Bruyns, which was published in Bothalia 39 (2009: 219), is illegitimate since it was used before for a species from Mexico (Ule 1908). A new name is proposed for the species from Angola.

Euphorbia neochamaeclada *Bruyns*, nom. nov.

E. chamaeclada Bruyns in Bothalia 39: 219 (2009). Type: Angola, Namibe Dist., 10 km towards Sao Nicolau, 300 m, January 2006, *Bruyns 10402a* (BOL, holo.; E, MO, iso.), nom illegit., non Ule (1908).

REFERENCES

BRUYNS, P.V. 2009. A new species of succulent *Euphorbia* from southern Angola. *Bothalia* 39: 219–221.

ULE, E. 1908. Beiträge zur Flora von Bahia. I. *Botanische Jahrbücher* 42: 191–238.

P.V. BRUYNS*

---

* Bolus Herbarium, University of Cape Town, Private Bag, 7700 Rondebosch.

MS. received: 2010-05-18.

POACEAE

TWO NEW SPECIES OF *HELICTOTRICHON* (POOIDEAE: AVENEAE) FROM SOUTH AFRICA

INTRODUCTION

Helictotrichon Besser ex Schult. & Schult.f. (excluding *Avenula* (Dumort.) Dumort. and *Amphibromus* Nees) is a genus of temperate C_3 grasses with about 40 species (Gibbs Russell *et al.* 1990; Mabberley 2008). The genus is most diverse in the temperate regions of the northern hemisphere, especially Europe, from where it extends southwards through the African mountains (Afromontane Region) with a secondary centre of diversity in southern Africa.

In a taxonomic revision of *Helictotrichon* for southern Africa, Schweickerdt (1937) recognized 12 indigenous species. Except for one, all of these species are endemic to southern Africa, several of which are rare and known from very few collections. A possible new species of *Helictotrichon, H.* sp. (*Ellis 4663*), is mentioned by Gibbs Russell *et al.* (1990). During a taxonomic revision of the genus, the status of this new species was confirmed and a second new species was identified. Note that at PRE, specimens of the second new species were initially identified as *H. namaquense* Schweick., hence the distribution map supplied for *H. namaquense* in Gibbs Russell *et al.* (1990) applies to this new species. In the present contribution, the two new species are described, illustrated and compared with similar members of the genus.

Helictotrichon rogerellisii *Mashau, L.Fish & A.E.van Wyk*, sp. nov., *H. longifolio* (Nees) Schweick. arcte affinis foliis setaceis spiculisque laxifloris, sed spiculis 13–18 mm longis (arista exclusa) usque ad 4.5 mm latis; glumis acutis, internodio rachillae 2.8–3.3 mm longo differt.

TYPE.—Western Cape, 3420 (Bredasdorp): 2 km from De Hoop Nature Reserve entrance, on road to Wydgelegen, (–AD), 21 October 1984, *R.P. Ellis 4663* (PRE, holo.!; K, iso.).

Densely tufted perennial, 300–600 mm high, usually flushed purple; culms slender, glabrous, 1- or 2-noded. *Leaves* cauline, sheath folded; blade 100–200 × 1.5 mm, setaceous, involute, both surfaces scabrid; ligule an unfringed membrane up to 2 mm long, laciniate or erose; margins membranous. *Panicle* open, with up to 15 spikelets, branches bare of spikelets for most of their length; branches and pedicels smooth but with short scattered hairs; pedicels unequal in length. *Spikelets* 13–18 × up to 4.5 mm (excluding awns), laterally compressed, loosely 3- or 4-flowered, variegated, usually mostly dark purple with margins and/or apices light brownish yellow; rachilla internode 2.8–3.3 mm long, densely hairy on upper half, hairs 0.5–4.5 mm long, increasing in size upwards. *Glumes* unequal, narrowly lanceolate, acute, minutely awned, hairy on upper margins; lower glume $^{2}/_{3}$ as long as upper glume, 1-nerved; upper glume $^{2}/_{3}$ as long as spikelet, 3-nerved. *Lemma* usually purple from awn insertion to base, otherwise light brownish yellow, scaberulous (Figure 10B), nerves raised, 2-lobed; lobes 1.5–2.5 mm long (including awn) from above central awn insertion to apex, awn up to 1.5 mm long; central awn 11.0–21.5 mm long, twisted below, geniculate, scabrid; callus 1 mm long, apex cuneate, hairy all over except on disarticulation scar. *Palea* 2-toothed, 2-keeled, keels hairy. *Anthers* 3.8–4.5 mm long, yellow. *Flowering time*: October. Figure 8.

Diagnostic characters and affinities: *Helictotrichon rogerellisii* is similar to *H. longifolium* (Nees) Schweick., possibly its nearest relative. Both species have setaceous leaves and loosely flowered spikelets, but they differ in a number of characters, summarized in Table 1.

Distribution and ecology: the species is only known from a single collection by R.P. Ellis in the De Hoop Nature Reserve, east of Bredasdorp, Western Cape (Figure 9). Plants grow in shallow, humic soil among limestone outcrops and are associated with De Hoop Limestone Fynbos (Mucina & Rutherford 2006). Biogeographically this locality falls within the Agulhas Plain Subcentre of the Cape Floristic Region (Goldblatt & Manning 2000).

Eponymy: the specific epithet honours Roger Pearson Ellis (1944–), formerly of the Botanical Research Institute—a predecessor of the South African National Biodiversity Institute—who researched and published extensively on the anatomy of southern African grasses.

Helictotrichon roggeveldense *Mashau, L.Fish & A.E.van Wyk*, sp. nov., *H. namaquensi* Schweick. arcte affinis lemmatibus partim scabridis, carinisque palearum conspicue pubescentibus, sed paniculis contractis spicu-

TABLE 1.—Differences between *Helictotrichon rogerellisii* and *H. longifolium*

Character	*H. rogerellisii*	*H. longifolium*
Spikelet length	13–18 mm	8–10(–12) mm
Glumes (apices)	acute	acuminate
Rachilla internode length	2.8–3.3 mm	± 2 mm
Lemma	scaberulous	smooth or finely papillate
Lemma nerves	raised	not raised
Anther length	3.8–4.5 mm	0.6–3.3 mm
Geographical range	Bredasdorp District, Western Cape (Agulhas Plain Subcentre, Cape Floristic Region)	Drakensberg Range, centred on Lesotho (Drakensberg Alpine Centre)
Habitat	fynbos; mainly in shallow, humic soils between limestone outcrops on coastal plain	grassland; mainly on moist and rocky mountain slopes

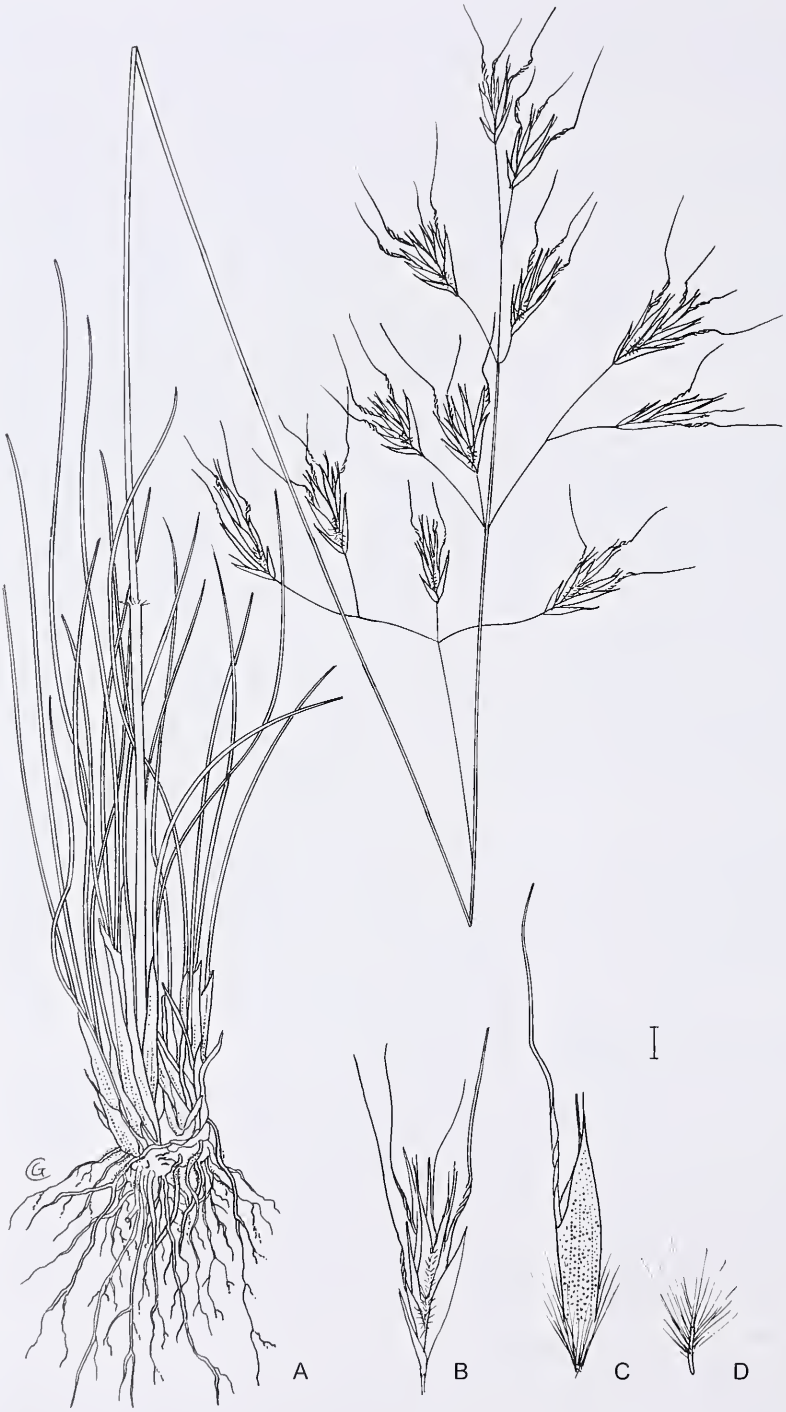


FIGURE 8.—*Helictotrichon rogerellisii, R.P. Ellis 4663* (PRE). A, habit; B, spikelet; C, lemma; D, rachilla. Scale bar: A, 5 mm; B, 10 mm; C, D, 20 mm. Artist: Gillian Condy.

las 15–18 gerentibus, spiculis flosculis aggregatis, lemmaque scabrida differt.

TYPE.—Northern Cape, 3220 (Sutherland): Geelhoek (Vyffontein), (–BC), 21 September 1953, *J.P.H. Acocks 17178* (PRE, holo.!).

Densely tufted perennial, 250–280 mm high; culms slender, 1- or 2-noded. *Leaves* mainly basal, sheath strongly ribbed; leaf blade 80–180 × 2–3 mm, expanded or convolute, narrowed towards apex, apex boat-shaped, strongly ribbed, both surfaces hairy; ligule an unfringed membrane, 1.5–2.8 mm long, laciniate or erose; margins membranous. *Panicle* contracted; spikelets 15–18, lower branches sometimes spreading, pulvini in axils absent, branches and pedicels scabrid; pedicels unequal in length. *Spikelets* 10–17 × 2.5–3.0 mm (excluding

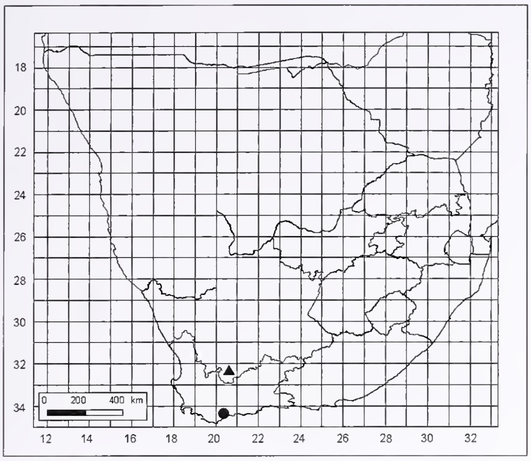


FIGURE 9.—Known distribution of *Helictotrichon rogerellisii*, ●; and *H. roggeveldense*, ▲.

awns), laterally compressed, closely 2- or 3-flowered, pallid (light green) occasionally flushed purple; rachilla internode 2.5–3.0 mm long, densely hairy on upper half, hairs 4.0–6.5 mm long. *Glumes* unequal, lanceolate, acuminate, minutely ciliate on upper margins; lower glume $^{1}/_{2}$–$^{2}/_{3}$ as long as upper glume, 1-nerved; upper glume ± as long as spikelet (excluding awns), 3-nerved. *Lemma* body densely scabrid (Figure 10A), smooth at base, nerves conspicuous, apex 2-lobed; lobes 5–7 mm long (excluding awn) from insertion of central awn to apex, awn 3.0–5.0 mm long; central awn 12–25 mm long, twisted below, geniculate, scabrid; callus 1 mm long, apex cuneate, hairy all over except on disarticulation scar, hairs up to 6 mm long. *Palea* emarginate, apex fimbriate, 2-keeled, keels hairy. *Anthers* 1.7–2.6 mm long, yellow. *Flowering time*: September. Figure 11.

Diagnostic characters and affinities: *Helictotrichon roggeveldense* resembles *H. namaquense* Schweick. in having spikelets with the lemmas scabrid in parts and the keels of the paleae conspicuously hairy, but the two species differ in a number of characters, some of which are compared in Table 2. In Gibbs Russell *et al.* (1990), *H. roggeveldense* was mistaken for *H. namaquense* Schweick., a rare species and near-endemic to the Kamiesberg Centre of Endemism (Van Wyk & Smith 2001; Helme 2009), with an outlier distribution on the Hantamsberg near Calvinia, the latter locality which biogeographically forms part of the Hantam-Roggeveld Centre of Endemism.

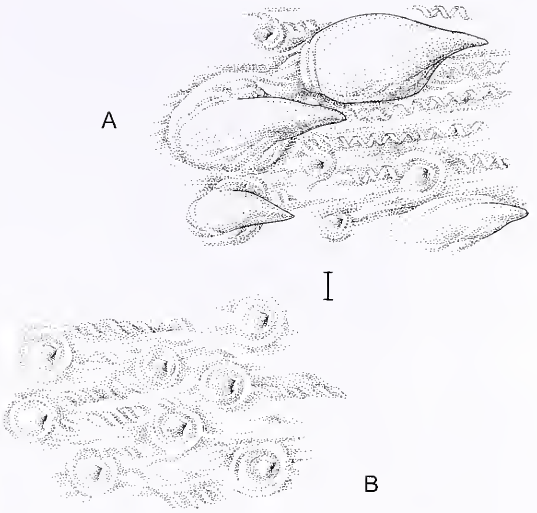


FIGURE 10.—*Helictotrichon roggeveldense*: A, scabrid lemma surface. *H. rogerellisii*: B, scaberulous lemma surface. Scale bar: A, B, 10 μm. Artist Gillian Condy.

Distribution and ecology: known only from three collections from two localities south and southwest of Sutherland (Northern Cape), where it is associated with Roggeveld Shale Renosterveld (Mucina & Rutherford 2006) (Figure 9). The area is characterized by sandy to clayey soils derived from mudstone and sandstone of the Beaufort Group. The species is obviously rare and is yet another taxon endemic to the Roggeveld Subcentre of the Hantam-Roggeveld Centre of Endemism (Van Wyk & Smith 2001). The current range of *H. roggeveldense* is closely associated with that of another grass, *Secale africanum* Stapf [= *Secale strictum* (J.Presl) J.Presl subsp. *africanum* (Stapf) K.Hammer], a Roggeveld Subcentre endemic today and on the brink of extinction in the wild, but previously apparently more abundant, though still localized, on deep alluvial soils mainly along the banks of the upper Fish River and its tributaries. The rapid demise of *S. africanum* is ascribed primarily to overgrazing by domestic stock (mainly sheep) following the colonization of the area by farmers in the late 18th century. *H. roggeveldense* may be under similar pressure with its current rarity indicative of

TABLE 2.—Differences between *Helictotrichon roggeveldense* and *H. namaquense*

Character	*H. roggeveldense*	*H. namaquense*
Panicle	contracted	open
Pulvini in branch axils	absent	present; purple
Spikelets per inflorescence	15–18	up to 10
Spikelet	closely flowered	loosely flowered
Lemma	scabrid all over, except on lobes and basally	scabrid below awn insertion in a band from margin to margin, rest of body scaberulous
Anther length	1.7–2.6 mm	4.5 mm
Geographical range	Sutherland District (Roggeveld Subcentre, Hantam-Roggeveld Centre of Endemism)	mainly Kamiesberg, Namaqualand (Kamiesberg Centre of Endemism); outlier on Hantamsberg, Calvinia
Habitat	renosterveld; mainly on sandy to clayey soils derived from shale	renosterveld; mainly on sandy soils arising from granite and gneiss

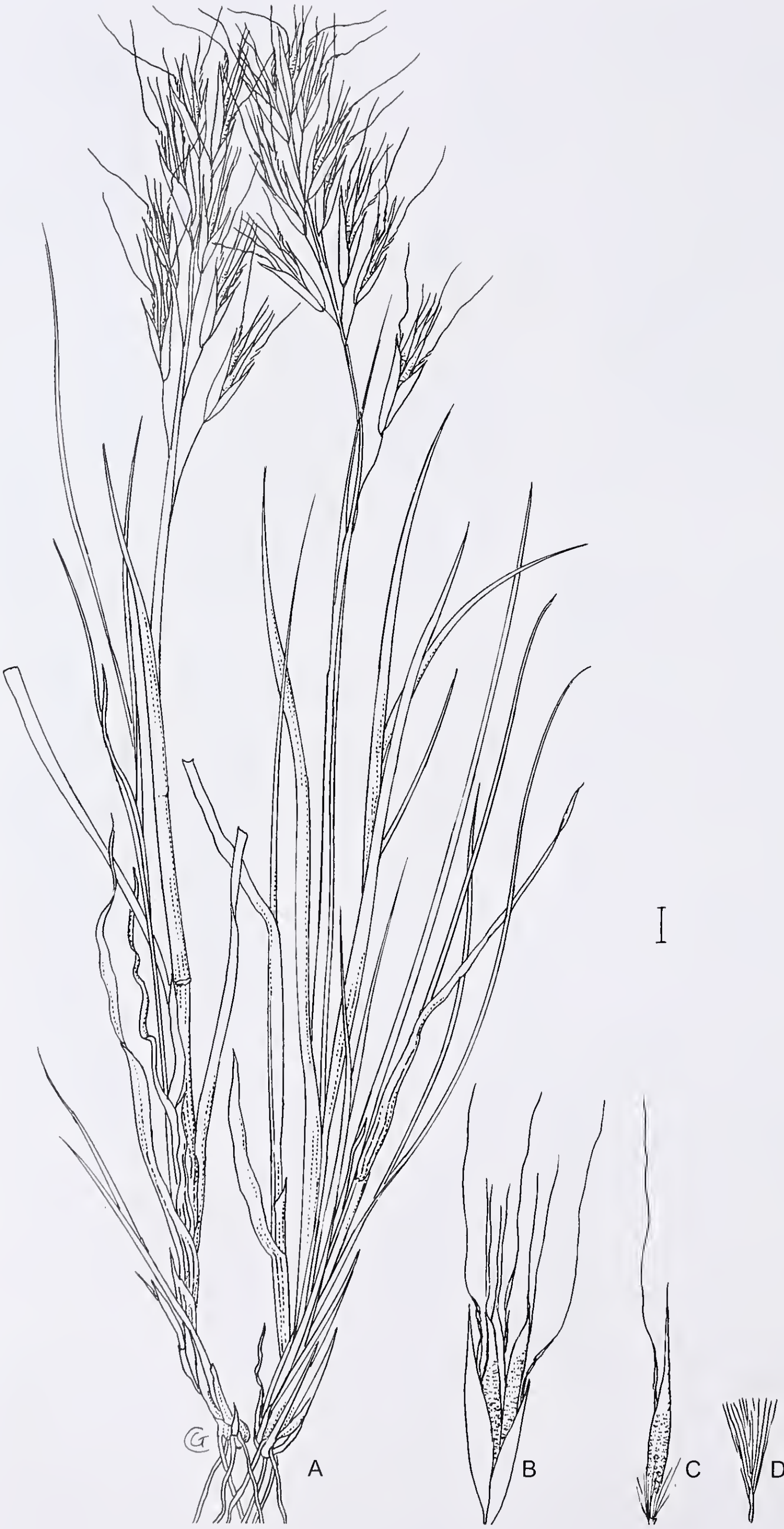


FIGURE 11.—*Helictotrichon roggeveldense*, *J.P.H. Acocks 17178* (PRE). A, habit; B, spikelet; C, lemma; D, rachilla. Scale bar: A, 5 mm; B, C, 10 mm; D, 20 mm. Artist: Gillian Condy.

survival as a relict in sites protected from overgrazing. The most recent collections of *H. roggeveldense* (September 1986) are from plants in a road reserve where they enjoyed some protection from grazers.

Etymology: *Helictotrichon roggeveldense* is named after the Roggeveld (rye lands/fields), a region named after *Secale africanum* (known as *wilde rog* in Afrikaans), an important grazing grass and a Roggeveld

Subcentre endemic which was once more common, but is very rare today.

Additional specimens examined

NORTHERN CAPE.—3220 (Sutherland): 10 km from Sutherland to Matjiesfontein, (–BC), 29 September 1986, *Spies 3137* (PRE); 10 km south of Sutherland on road to Ceres, (–BC), 29 September 1986, *Ellis 5117* (PRE).

ACKNOWLEDGEMENTS

Our grateful thanks to Dr O.A. Leistner for commenting on the manuscript and translating the diagnoses into Latin, Gill Condy for the line drawings and Hester Steyn for the distribution map. The South African National Biodiversity Institute is thanked for financial support.

REFERENCES

GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L., BARKER, N.P., ANDERSON, H.M. & DALLWITZ, M.J. 1990. Grasses of southern Africa. *Memoirs of the Botanical Survey of South Africa* No. 58. Botanical Research Institute, Pretoria.

GOLDBLATT, P. & MANNING, J.C. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9: 1–743. National Botanical Institute, Pretoria and Missouri Botanical Garden Press, St. Louis.

HELME, N. 2009. A description of the endemic flora and vegetation of the Kamiesberg Uplands, Namaqualand. *PlantLife* 37 & 38: 12–31.

MABBERLEY, D.J. 2008. *Mabberley's plant-book*, edn 3. Cambridge University Press. Cambridge.

MUCINA, L. & RUTHERFORD, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

SCHWEICKERDT, H.G.W.J. 1937. A revision of the South African species of *Helictotrichon* Bess. ex Schultes. *Bothalia* 3: 185–203.

VAN WYK, A.E. & SMITH, G.F. 2001. *Regions of floristic endemism in southern Africa. A review with emphasis on succulents.* Umdaus Press, Pretoria.

A.C. MASHAU*[†], L. FISH* and A.E. VAN WYK**

---

* South African National Biodiversity Institute, Private Bag X101, 0002 Pretoria.

[†] Student affiliation: Department of Plant Science, University of Pretoria, 0002 Pretoria.

E-mail: c.mashau@sanbi.org.za; l.fish@sanbi.org.za.

** H.G.W.J. Schweickerdt Herbarium, Department of Plant Science, University of Pretoria, 0002 Pretoria. E-mail: braam.vanwyk@up.ac.za.

MS. received: 2009-10-21.

FABACEAE

TAXONOMIC STATUS OF *ELEPHANTORRHIZA RANGEI* (MIMOSOIDEAE)

Elephantorrhiza rangei was first described by Harms (1913) from a specimen, *Range 455*, collected in January 1908 at Naute in the Keetmanshoop District, southern Namibia. Paul Range (1879–1952) was a government geologist by occupation but also an avid naturalist that travelled extensively throughout Namibia. He documented his travels to Namaland (1906–1914) in great detail and recorded many noteworthy and lesser-known facts of the plant life, climate and general ecology of the areas he visited. His observations were written up in a series entitled '*Die Flora des Namalandes*' in *Feddes Repertorium* from 1932 to 1938. His personal herbarium collections exceed 2 000, most of which were sent to Berlin (B), resulting in the description of many new species (Gunn & Codd 1981).

In recent years, *Elephantorrhiza rangei* has been known for certain from the type collection only. Specimens attributed to *E. rangei* by Phillips (1923) were subsequently shown by Ross (1975) to be incorrectly identified as *E. elephantina* (Burch.) Skeels. In the absence of any further collections besides that of Range, Ross (1975) hinted that *E. rangei* might be extinct and he recommended a search at the type locality to evaluate and determine its conservation status. Ross nevertheless noted a superficial resemblance between the type material of *E. rangei* and *E. suffruticosa* Schinz, a species from further north in Namibia and beyond.

In 2005, the first author visited southern Namibia to conduct a search for plants matching the description of *Elephantorrhiza rangei* in the general area of Keetmanshoop, Seeheim and the Naute Recreation Resort. Since Range's travels in southern Namibia a century ago, considerable change has taken place. The Naute Dam, one of Namibia's largest dams with a capacity of 84 million m^3, was constructed in 1970–1972 to supply the arid southern areas of Namibia and specifically the town of Keetmanshoop with water. It is built in the Löwen River, a tributary of the Fish River. Initially it seemed that the dam was located where the mysterious *E. rangei* occurred and that its total habitat had been destroyed with the building of the dam, especially since the plant had not been recorded for the Namibian Tree Atlas Project (Curtis & Mannheimer 2005). However, a single plant of an *Elephantorrhiza* was located near the visitors' centre, close to the dam wall. Since it was just at the start of the flowering season, the small tree did not have any leaves on it. Inflorescences, ready to undergo anthesis, were visible on all the branches. Some dried leaf material was collected from under the tree where it had fallen after senescence during the winter months. The racemes, leaves and especially the leaflets (*Krige 451* in PRE and PRU) were studied to determine if the plant could be the rediscovery of the elusive *Elephantorrhiza rangei*.

Comparative morphology confirms beyond doubt that this plant at the Naute Dam is conspecific with *Elephantorrhiza suffruticosa*. The original distinction between *E. rangei* and *E. suffruticosa* was based mainly on a character of the leaflets. In *E. suffruticosa*, the midrib of the leaflet is usually described as marginal throughout. In *E. rangei* it is marginal becoming central towards the apex (Ross 1974, 1975)—which is also the case in the leaflets of the plant at Naute. However, in *E. suffruticosa*, the midrib occasionally tends toward a central position and the leaflets from Naute clearly fall within the currently known range of variation in *E. suffruticosa*. In addition, Ross (1975) claimed that in the flowers of *E. rangei*, the calyx is 2.0–2.25 mm long, whereas in typical *E. suffruticosa* it is 1 mm long. However, this claimed floral difference does not hold because measurements taken from several herbarium specimens showed the calyx length of the type material of *E. rangei* to comfortably fall within the range of calyx length variation displayed by *E. suffruticosa*, namely 0.4–1.5 mm. It is possible that Ross (1975) erroneously compared the measurement of the corolla in *E. rangei* with that of the calyx in *E. suffruticosa*. In all other characters the original description of *E. rangei* conforms to that of *E. suffruticosa*.

The outlier distribution at Naute is near the southernmost limit of the range of *Elephantorrhiza suffruticosa*. Hitherto the species has been recorded from northwestern and central Namibia whence it ranges north into Angola, but with an intriguing disjunct range extension in the extreme southeast of Namibia (grid: 2719 AD) represented by a single herbarium record, *Curtis 1530* in WIND (Curtis & Mannheimer 2005). The present confirmation of the presence of the species at Naute bridges this disjunction (Figure 12). Further sampling is recommended in the extreme southern and southeastern parts of Namibia, especially the botanically poorly explored Klein and Groot Karasberge, to ascertain the full range for the species in southern Namibia. Other possible localities were explored in the general area of Keetmanshoop, Seeheim and the Naute Recreation Resort, but no *E. suffruticosa* plants could be located. However, from the observations made and the plant found, it is evident that Harms had mistaken the rather poor specimen presented to him by Range for a new species. The name is therefore formally placed into synonymy with *E. suffruticosa*. Specimens seen on the Aluka Library website (http://www.aluka.org/) are distinguished by the code e! in the citations below.

Elephantorrhiza suffruticosa *Schinz* in Mémoires de l'Herbier Boissier 1: 117 (1900). Type: Angola, Huila Dist., 'Kilevi am Kunene' (south of Humbe), *Schinz 2071* (Z, lecto.).

E. rangei Harms (1913): 420 (1913), syn. nov. Type: South West Africa, Keetmanshoop Dist., Naute, near Keetmanshoop, *Range 455* (B, holo.; BM, drawing, e!; BOL, iso.; SAM, e!).

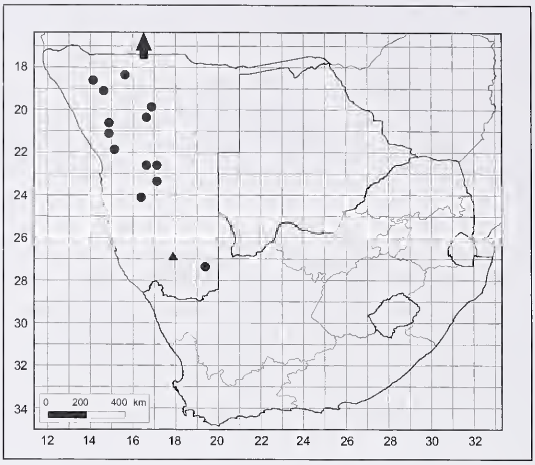


FIGURE 12.—Known distribution of *Elephanthorrhiza suffruticosa* in the *Flora of southern Africa* region, ●. The type locality of *E. rangei*, here proposed as conspecific with *E. suffruticosa*, is also indicated, ▲.

REFERENCES

CURTIS, B.A. & MANNHEIMER, C.A. 2005. *Tree atlas of Namibia*. Windhoek, National Botanical Research Institute.

GUNN, M. & CODD, L.E. 1981. *Botanical exploration of southern Africa*. Balkema, Cape Town.

HARMS, H. 1913. Leguminosae africanae. VI. *Elephantorrhiza*. *Botanische Jahrbücher* 49: 420.

PHILLIPS, E.P. 1923. Species of *Elephantorrhiza* in the South African herbaria. *Bothalia* 1: 187–193.

ROSS, J.H. 1974. The genus *Elephantorrhiza*. *Bothalia* 11: 247–257.

ROSS, J.H. 1975. *Elephantorrhiza*. *Flora of southern Africa* 16,1: 138–150.

SCHINZ, H. 1900. Die Pflanzenwelt Deutsch-Südwest-Afrikas. *Mémoires de l'Herbier Boissier* 1: 117, 118.

A. GROBLER* and A.E. VAN WYK**

---

* National Herbarium, South African National Biodiversity Institute, Private Bag X101, 0001 Pretoria. Student affiliation: Department of Plant Science, University of Pretoria, Pretoria. E-mail: a.grobler@sanbi.org.za.

** H.G.W.J. Schweickerdt Herbarium, Department of Plant Science, University of Pretoria, 0002 Pretoria. E-mail: braam.vanwyk@up.ac.za.

MS. received: 2009-09-15.

POACEAE

THE CORRECT AUTHOR CITATION OF *HELICTOTRICHON* (POOIDEAE: AVENEAE)

The purpose of this note is to clarify the confusion in the literature regarding the author citation for the generic name *Helictotrichon*. Schweickerdt (1937), Chippindall (1955) and Dyer (1976), amongst others, give it as 'Besser ex Schult.'; Gibbs Russell *et al.* (1990), following Kew (e.g. Launert 1971), cite 'Schult.'; Watson & Dallwitz (1994) quote it as 'Besser ex Roem. & Schult.'; Tucker (2007) gave it yet another variation, namely 'Besser ex Schult. & Schult.f.'; Mabberley (1997, 2008) gave the author as 'Besser'; and this was followed by Fish (2000).

The genus name *Helictotrichon* is apparently a spelling variation of *Elictotrichon*, a name that first appeared in 1823 as part of the species name *Elictotrichon sempervirens* Besser ex Andrz. in a list of names (*Rys botaniczny* 1: 9) by Antoni Lukianowicz Andrzejovski, a Russian botanist of Polish descent who studied botany under Wilibald Swibert Joseph Gottlieb von Besser (Schweickerdt 1937). The name, however, was not accompanied by any description and is therefore a *nomen nudum*. Subsequently the name *Helictotrichon* was validated by J.A. & J.H. Schultes (1827) in *Mantissa systematis vege-*

tabilium 3. Addit. I: 526 (in error as 326). These authors, without any comments, cited a letter by Von Besser in which he proposed a new classification of *Avena* and *Trisetum,* dividing these into a number of genera, one of which is *Helictotrichon* (Schweickerdt 1937; Sevenster & Veldkamp 1983).

Whereas *Systematis Vegetabilium*, vols 1–4 were co-authored by J.J. Roemer and J.A. Schultes, the *Mantissa* of 1827 was prepared by J.A. & J.H. Schultes (Stafleu & Cowan 1985). Therefore it is wrong to add Roemer as an author for *Helictotrichon.* As *Helictotrichon* Besser was validly published by J.A. Schultes & J.H. Schultes (1827), the correct author citation of the genus should be **Helictotrichon** *Besser ex Schult. & Schult.f.*

REFERENCES

CHIPPINDALL, L.K.A. 1955. A guide to the identification of grasses in South Africa. In D. Meredith, *The grasses and pastures of South Africa*. Central News Agency, Cape Town.

DYER, R.A. 1976. *The genera of southern African flowering plants*, Gymnosperms and monocotyledons vol. 2: 835. Department of Agricultural Technical Services, Pretoria.

GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L., BARKER, N.P., ANDERSON, H.M. & DALLWITZ, M.J. 1990. Grasses of southern Africa. *Memoirs of the Botanical Survey of South Africa* No. 58.

FISH, L. 2000. Poaceae (Gramineae). In O.A. Leistner, Seed plants of southern Africa: families and genera. *Strelitzia* 10: 659–726. National Botanical Institute, Pretoria.

LAUNERT, E. 1971. Gramineae. In A. Fernandes *et al., Flora zambesiaca* 10,1. Crown Agents London.

MABBERLEY, D.J. 1997. *The plant-book.* A portable dictionary of the vascular plants, edn 2. Cambridge University Press.

MABBERLEY, D.J. 2008. *Mabberley's plant-book*, edn 3. Cambridge University Press.

SCHULTES, J.A. & SCHULTES, J.H. 1827. *Mantissa in volumen tertium systematis vegetabilium Caroli a Linné.* Cotta, Stuttgart.

SCHWEICKERDT, H.G.W.J. 1937. A revision of the South African species of *Helictotrichon* Bess. ex Schultes. *Bothalia* 3: 185–203.

SEVENSTER, J.C. & VELDKAMP, J.F. 1983. A revision of *Helictotrichon* (Gramineae) in Malesia. *Blumea* 28: 329–342.

STAFLEU, F.A. & COWAN R.S. 1985. *Taxonomic literature*, edn 2, vol. 5: Sal-Ste: 366. Bohn, Scheltema & Holkema, Utrecht/Antwerpen dr. W. Junk b.v., publisher, The Hague/ Boston.

TUCKER, G.C. 2007. *Helictotrichon* Besser ex Schult. & Schult.f. *Flora of North America* 24: 701–702. Oxford University Press, New York, Oxford.

WATSON, L. & DALLWITZ, M.J. 1994. *The grass genera of the world*, revised edn. CAB International, Oxon.

A.C. MASHAU*[†], L. FISH* and A.E. VAN WYK**

---

* South African National Biodiversity Institute, Private Bag X101, 0001 Pretoria.

[†] Student affiliation: Department of Plant Science, University of Pretoria, 0002 Pretoria.

E-mail: c.mashau@sanbi.org.za; l.fish@sanbi.org.za.

** H.G.W.J. Schweickerdt Herbarium, Department of Plant Science, University of Pretoria, 0002 Pretoria. E-mail: braam.vanwyk@up.ac.za.

MS. received: 2010-05-25.

ASTERACEAE

BERKHEYA CHRYSANTHEMOIDES AND *HETERORHACHIS HYSTRIX*, TWO NEW SPECIES OF ARCTOTIDEAE–GORTERIINAE FROM THE SOUTHWESTERN CAPE

Berkheya

Berkheya Ehrh. (1788), comprising ± 80 species, is concentrated in southern Africa with four species extending northwards into Angola and tropical East Africa (Roessler 1959; Bremer 1994; Karis *et al.* 2009). The genus is distinguished by the production of latex, a shrubby or perennial habit, spine-tipped or -lobed involucral bracts that are basally connate, mostly radiate (rarely discoid) capitula with yellow (rarely white or mauve) ray florets that are neuter and often apically four-lobed, a ± deeply alveolate receptacle with the walls of the outer and inner cavities uniformly thin-walled, and a pappus of mostly ± 20 denticulate scales in one or two rows, either short or longer and bristle-like. Most species are herbaceous, sometimes rosulate perennials, and fewer than 20 species are subshrubs or true shrubs. A recent collection of a shrubby taxon from the Bokkeveld Mountains in Northern Cape at the northern limit of the Cape Floral Region represents an undescribed species that is named for the attractive, conspicuously radiate capitula.

Berkheya chrysanthemoides *J.C.Manning & Goldblatt*, sp. nov.

Frutex multiramosa ad 1.7 m alta, foliis alternatis pinnatifidis minute glanduloso-pubescentibus glabrescentibus, primo adspectu maxime simile *Berkheya spinosa* sed foliis profunde lobatis capitulis conspicue radiatis 40–55 mm diam. disco ± 15 mm diam, radiis 18–25 × 4–5 mm.

TYPE.—Northern Cape, 3119 (Calvinia): Nieuwoudtville, Oorlogskloof Nature Reserve, (–AC), 28 September 2000, *Pretorius 540* (NBG, holo.; PRE, iso.).

Much-branched shrub up to 1.7 m high; branches patent, leafy, minutely glandular-pubescent when young and flushed purple, later subglabrous. *Leaves* alternate, sessile, rigid, oblanceolate in outline, (20–)25–40(–50) × 8–20 mm, apex excurrent in yellowish spine 1–2 mm long, base scarcely narrowed, semi-amplexicaul, blade pinnatifid, 2- or 3-jugate, with smaller, deflexed lobe in distal axil of primary divisions, lobes triangular to narrowly triangular, shorter than, or as long as, width of undivided portion, excurrent in spine similar to apical spine and with smaller, antrose spines along margins, minutely glandular-pubescent on both surfaces but adaxial surface glabrescent and shining, with some cobwebby hairs in axils. *Capitula* 1–3 in shortly pedunculate corymbs at branch tips, radiate, 40–55 mm across expanded rays; florets yellow. *Involucral bracts* 3- or 4-seriate, basally connate in involucre ± 4 mm deep, patent-reflexed, ovate-lanceolate, excurrent in yellowish spine 2–3 mm long, margins with 2 or 3 pairs of patent spines similar to apical spine, sparsely and minutely glandular-pubescent, glabrescent, outer mostly 5–8 × 2–3 mm, median 10–12 × 3–4 mm, inner narrowly lanceolate, 6–8 × 1.5–2.0 mm. *Receptacle* deeply alveolate, margins irregularly fimbriate with straw-like spinules 1–2 mm long. *Ray florets* 12–14, neuter, tube ± 2.5 mm long, glandular-pubescent, limb oblanceolate, 18–25 × 4–5 mm. *Disc corollas* funnel-shaped, densely glandular-pubescent on tube and more sparsely along lobe margins, 8–9 mm long, tube ± 5 mm long, lobes erect, lanceolate, ± 3 mm long; anthers tailed with lanceolate apical appendage, ± 4.5 mm long; endothecial cells with inner periclinal wall reinforcements displaced towards the connective. *Pappus scales* uniseriate, ± 20, oblong-ovate, obtuse-truncate, denticulate, connate below, ± 0.3 × 0.2 mm. *Immature cypselae* obovoid, 2–3 × 1 mm, angled, densely antrorsely pubescent with short, twin hairs. *Pollen* lophate. *Flowering time*: August–September. Figures 13; 14A–E.

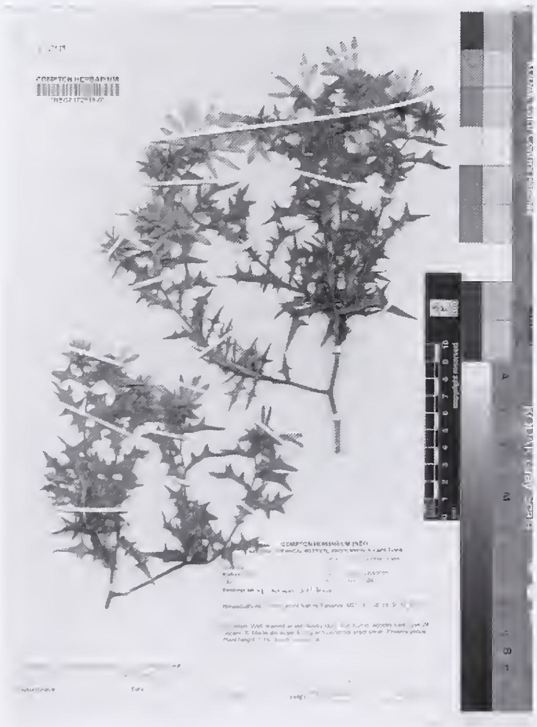


FIGURE 13.—*Berkheya chrysanthemoides*, *Pretorius 540* (NBG).

Ecology and distribution: apparently endemic to the Bokkeveld Escarpement, where it is known from a single collection made in the Oorlogskloof Nature Reserve near Nieuwoudtville (Figure 15). Plants were recorded as local and occasional on stony, south-trending sandstone slopes.

Diagnosis and relationships: *Berkheya chrysanthemoides* is a shrub up to 1.7 m tall with alternate, pinnatifid leaves that, like the young stems, are minutely glandular-pubescent but glabrous with age. It produces few-flowered corymbs of moderately-sized, radiate capitula 40–55 mm in diameter across the expanded rays, with a relatively small disc, ± 15 mm diam. The alveole margins are conspicuously fimbriate. The young cypselae are densely puberulous, with small, obtuse pappus scales, ± 0.3 mm long (Figure 14B, D).

In its subglabrous, shrubby habit and broad leaves, *Berkheya chyrsanthemoides* is superficially most similar to *B. spinosa* (L.f.) Druce but is readily distinguished from that species by the deeply lobed leaves and conspicuously radiate heads with rays 18–25 × 4–5 mm. The leaves of *B. spinosa* are toothed rather than lobed, with the teeth mostly less than half as wide as the undivided portion of the blade, the rays are almost linear and 10–15 × 1.5–2 mm, with a proportionally larger disc 15–25 mm in diameter, the alveole margins are ± entire or denticulate, and the cypselae are densely silky with a biseriate pappus of linear-subulate scales 3–7 mm long (Figure 14F). Other shrubby members of the genus with similar broad, toothed or pinnatifid leaves, notably *B canescens* DC., *B. coriacea* Harv., *B. cuneata* (Thunb.) Willd. and *B. fruticosa* (L.) Ehrh., all have partially or completely tomentose or felted leaves and, like *B. spinosa*, silky ovaries and cypselae with a biseriate pappus of lanceolate to subulate, acute scales, 1.5 mm or more long. In these species the endothecial cells have the inner periclinal wall reinforcements regularly distributed, and not displaced towards the connective, as found in *Berkheya chrysanthemoides* and also in the species of *Berkheya* series *Rigidae*.

The relationships of *Berkheya chrysanthemoides* are somewhat puzzling. The shrubby habit, radiate heads, and relatively broad leaves are consistent with *Berkheya* series *Fruticosae* Roessler but members of this series characteristically have entire or shortly toothed (rarely fringed) alveole margins, densely silky cypselae with the hairs often 1–4 mm long, and a ± biseriate pappus of lanceolate or subulate scales (Roessler 1959). The conspicuously fimbriate alveole margins, short cypsela twin hairs, and uniseriate pappus of short, obtuse scales in *B. chrysanthemoides* are typical of several members of series *Rigidae* Roessler, including *B. rigida* (Thunb.) Bolus & Wolley Dod, *B. heterophylla* (Thunb.) O.Hoffm and *B. viscosa* (DC.) Hutch. Most members of this series, however, are perennial herbs or suffrutices with discoid heads, with a true shrubby habit developed only in *B. cardopatifolia* (DC.) Roessler from the Great and Upper Karoo and in *B. draco* Roessler from the KwaZulu-Natal Drakensberg. Other features characteristic of series *Rigidae* are the lanceolate, subacute apical anther appendages, endothecial thickenings displaced towards the connective, and the lophate pollen. Species of series *Fruticosae*, in contrast, mostly have ovate apical anther appendages, evenly distributed endothecial thickenings, and spinulose pollen. Pending further evidence, we therefore provisionally place *B. chrysanthemoides* in series *Rigidae* based on the characters of the anthers, cypselae and pappus. Its precise relationships remain to be determined but it is significant that the largest molecular phylogenetic analysis of the Arctotideae–Gorteriinae to date (Funk & Chan 2008) segregates a large portion of the sampled representatives of series *Rigidae* in one clade and most species of series *Fruticosae* in another.

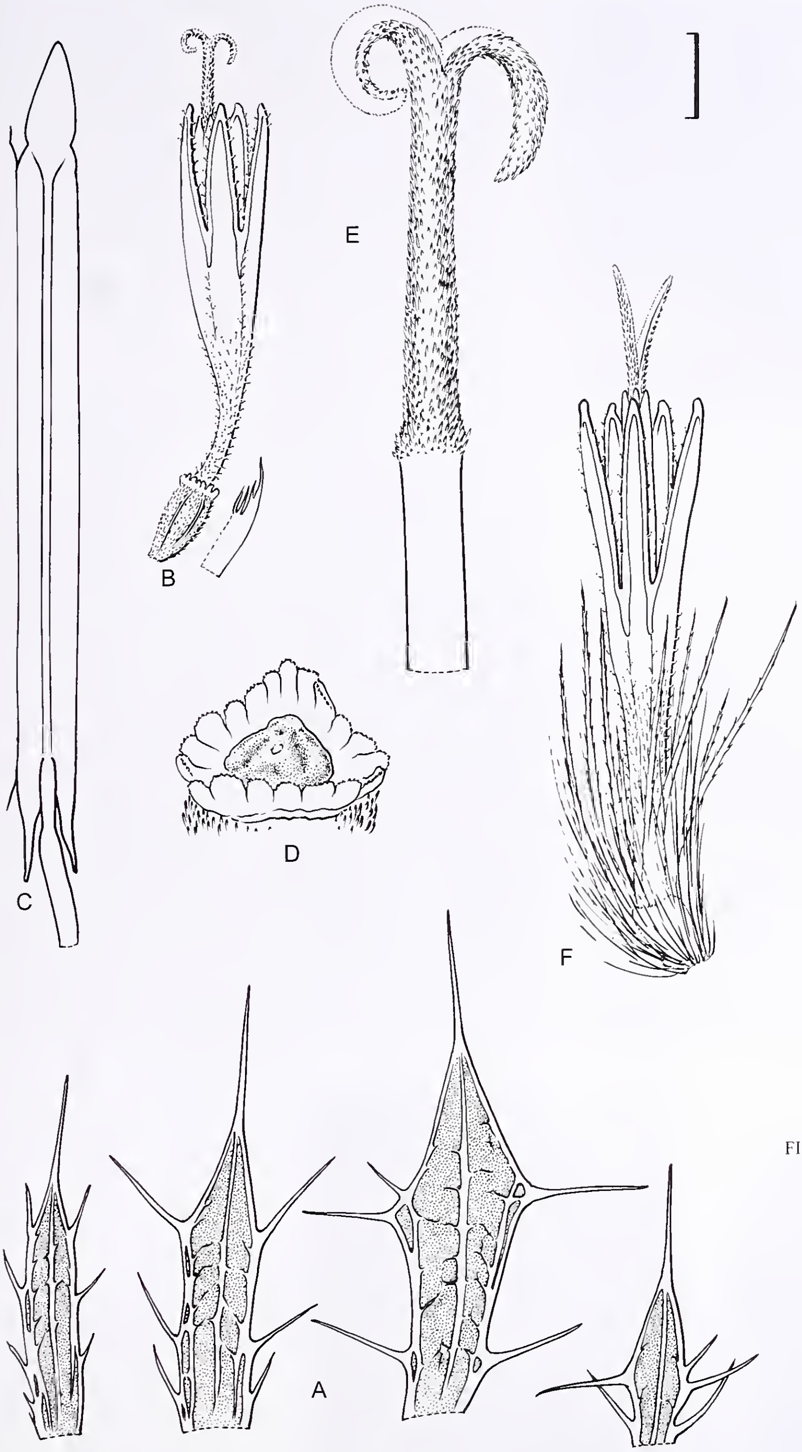


FIGURE 14.—A–E, *Berkheya chrysanthemoides*, *Pretorius 540*: A, involucral bracts (outermost on left, innermost on right); B, disc floret showing puberulous ovary and coroniform pappus of small, obtuse scales, plus portion of alveole margin; C, anther; D, apex of ovary showing pappus; E, apex of style showing stigma. F, *B. spinosa*: disc floret showing sericeous ovary and bristle-like pappus of subulate scales. Scale bar: A, B, F, 2 mm; C, E, 0.5 mm; D, 1 mm. Artist: John Manning.

Heterorhachis

This new species of *Heterorhachis* Sch.Bip. ex Walp., which appears to have been discovered in 1938 by T.M. Salter, has been collected just three times since then. It was overlooked until Goldblatt & Manning (2000) identified it as a novelty in their conspectus of the Cape Flora as *Heterorhachis* sp. 1. The rediscovery of the species by Cape Town conservationist Nick Helme has enabled us to describe it formally. The epithet *hystrix* (porcupine) alludes to the spiny, greyish leaves on the older stems.

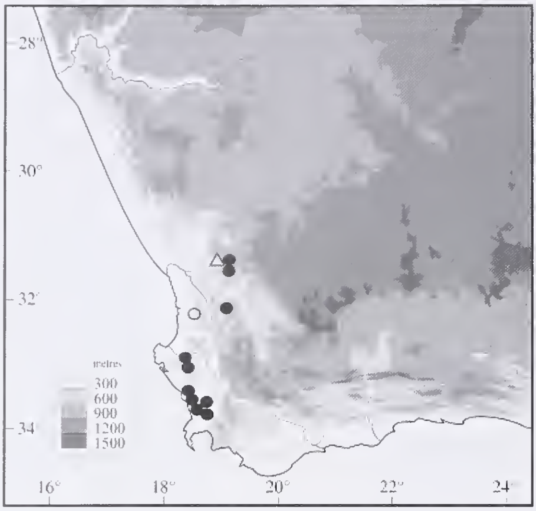


FIGURE 15.—Known distribution of *Berkheya chrysanthemoides*, △; *Heterorhachis hystrix*, ○; and *H. aculeata*, ●.

Heterorhachis hystrix *J.C.Manning & P.O.Karis*, sp. nov.

Heterorhachis aculeata (Burm.f.) Roessler valde similis, sed capitulis discoideis, bracteis involucri exterior 3 seriebus ovatis foliaceis integris, a foliis bene dissimilibus, usque ad ± 20 × 8 mm, flavo-virentibus pallentibus, cypselis tantum trichomatibus glanduliferis varie longis, et squamis pappis leviter brevibus distinguitur.

TYPE.—Western Cape, 3218 (Clanwilliam): Graafwater, along road towards, Sandberg, close to electric power station, 32° 11.35'S, 18° 36.00'E, (–BA), 31 August 2006, *Stångberg & Karis 3* (NBG, holo.; S, iso.).

Shrublet up to 1 m high, branching from near base, with erect to ascending, closely leafy stems. *Stems* densely white-felted when young, later glabrescent. *Leaves* sessile, rigid, semi-amplexicaul, spreading or erect-spreading, becoming declinate, greyish and withering on older stems, blade cuneate in outline, 30–60 × 15–30 mm, pinnatisect, 3- or 4-jugate, rachis 3–4 mm wide at base, mostly bifurcate, sometimes trifurcate but median lobe declinate and smaller than laterals, lobes linear-lanceolate to lanceolate, largest (10–)20–50 × 2–3(–5) mm, becoming progessively smaller basipetally and reduced to series of spines at base, margins revolute, apex excurrent in yellow spine 2–3 mm long, cobwebbed when young but adaxial surface glabrescent, at length glabrous and shining, abaxial surface persistently white-felted. *Capitula* homogamous, discoid, terminal and axillary in upper axils forming dense, racemose synflorescences, 40–50 mm across involucral bracts. *Involucre* cup-shaped, leathery, ± 8 mm diam., bracts ± 4-seriate, glandular-puberulous on both surfaces, especially abaxially, yellowish green, ovate-lanceolate, apex excurrent in spine 1.0–1.5 mm long, outermost series reflexed, margins lightly recurved thus convex adaxially, ± 15 × 5 mm, with 2 or 3 pairs of spines in basal half, second and third series patent to erecto-patent, plane or margins lightly revolute in distal half, second series largest, ± 20 × 8 mm, with 1 or 2 pairs of sub-basal spines, third series slightly smaller, with 1 pair of basal spines, innermost series erect and forming collar along involucral margin, oblong, 4–7 × 2–3 mm, fimbriate-ciliate. *Receptacle* deeply alveolate with smooth walls, marginal pits very deep with leathery walls, completely enclosing ovary/cypsela and pappus and becoming indurated and woody in fruit, inner pits with thinner, membranous walls remaining papery in fruit, shallower and exposing pappus. *Marginal florets* ± 8, disc florets ± 18, corolla funnel-shaped, glandular, tube ± 6 mm long, lobes erect, lanceolate with sclerified margins, ± 3 mm long; anthers tailed, with lanceolate apical appendages ± 4.5 mm long; endothecial cells with ± entire inner periclinal wall reinforced. *Cypselae* turbinate, ± 2 × 1 mm, 10-ribbed, with scattered variously long glandular hairs, pale brown. *Pappus scales* biseriate, ± 10 + 10, lanceolate, outer series ± 1 mm long, inner series ± 1.8 mm long, with some short glandular hairs, fimbriate with some to many cilia gland-tipped. *Pollen* spinulose. *Flowering time*: August–September. Figures 16; 17A–F.

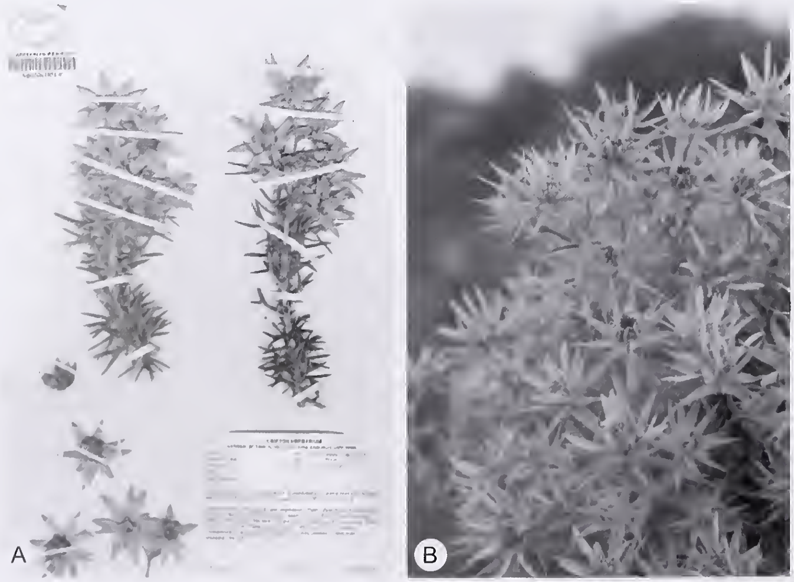


FIGURE 16.—A, *Heterorhachis hystrix*, *Helme 4284* (NBG), herbarium specimen. B, *H. aculeata*, Bokkeveld Mountains, no voucher: capitula. Photographer: B, John Manning.

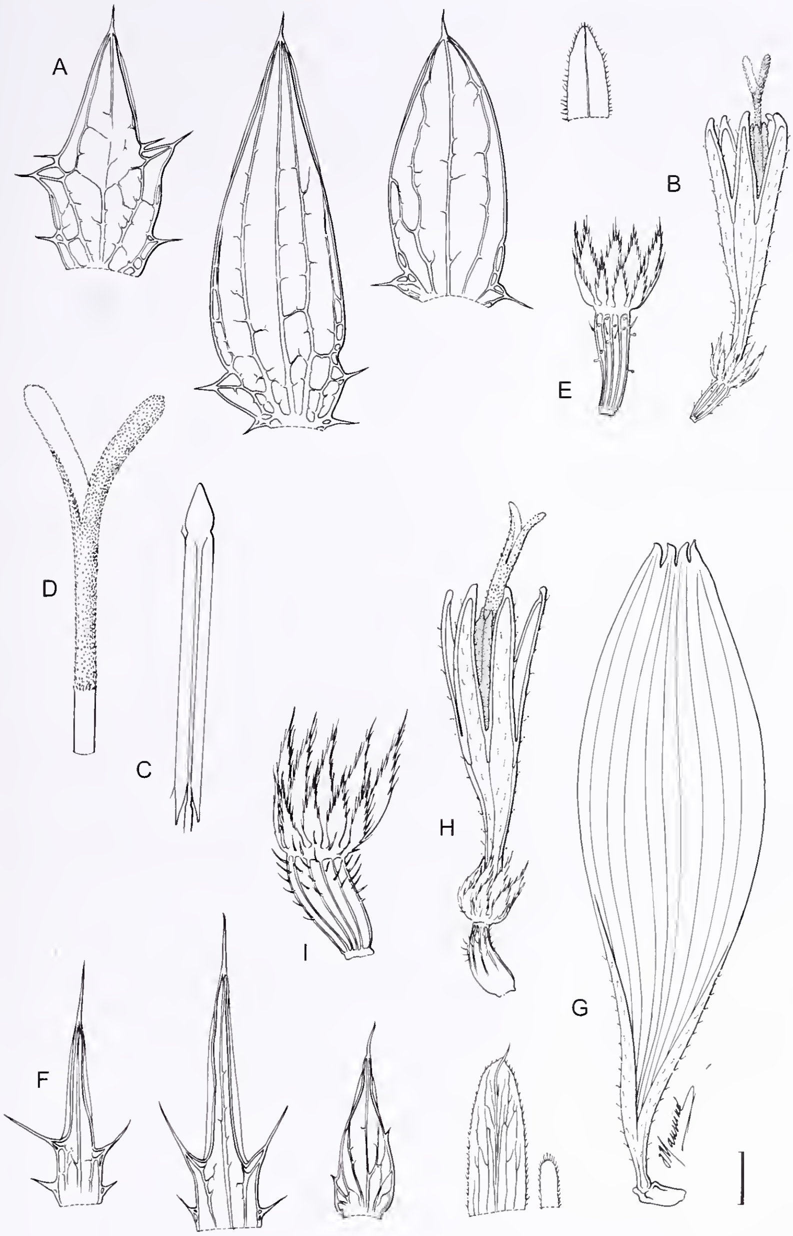


FIGURE 17.—A–E, *Heterorhachis hystrix, Barker 10421*: A, involucral bracts (outermost on left, innermost scale-like bract on right); B, floret; C, anther; D, apex of style showing stigma; E, cypsela. F–I, *H. aculeata, Low 3750*: F, involucral bracts (outermost on left, innermost on right); G, marginal floret; H, disc floret; I, cypsela. Scale bar: A, B, E–I, 2 mm; C, D, 1 mm. Artist: John Manning.

Distribution and ecology: known from four collections near the town of Graafwater, west of Clanwilliam (Figure 15). Plants grow in deep sandy soils, and recent observations suggest that there may be fewer than 100 plants extant.

Diagnosis and relationships: *Heterorhachis hystrix* is readily distinguished from *H. aculeata* by its discoid capitula with conspicuous, pale yellowish green or cream-coloured involucral bracts. The outer three series of bracts are subsimilar, ± foliaceous and ovate, 5–8 mm wide, with plane or only weakly revolute margins, but the bracts of the inner series are much smaller and scale like, forming a distinct collar-like rim protruding 2–3 mm above the preceding series. This collar becomes indurated and is very conspicuous in fruit after the corollas have abscised. The conspicuous involucral bracts may play an attractive function in the pollination biology of the species analogous to the ray corollas in *H. aculeata*. Both species have pappus scales with scattered glands, including some gland-tipped marginal cilia, a feature thus far unknown in other Arctotideae–Gorteriinae.

The species is very similar in leaf to *Berkheya ferox* O. Hoffm., although the lobes in this species are somewhat wider. However, the involucral bracts are much smaller and less conspicuous than in *Heterorhachis* and the cypselae and pappus scales are devoid of glandular hairs.

The capitula in *Heterorhachis aculeata*, in contrast to those in *H. hystrix*, are distinctly radiate with a relatively inconspicuous involucre concolorous with the leaves and with the outer three series of bracts resembling the foliage, thus narrowly lanceolate, 3–5 mm wide, and with conspicuously revolute margins. The cypselae bear shorter glands throughout as well as some short twin hairs in the upper half, and the pappus is slightly longer, the inner scales ± 3 mm long. The innermost bracts are oblong and either unarmed or pungent but rather variable in size, with the larger ones typically cucullate.

The two species appear to differ in their habit and ecology. The growth form in *Heterorhachis hystrix* is very characteristic, the plants branching near the base to produce short-lived, erect, rod-like stems up to 1 m tall, which die back after flowering and are replaced by a fresh flush of branches from near the base of the plant. The species, which is known from a single location on the intensively cultivated coastal plain, grows in well-drained, sandy soil with no evident bedrock, and the surrounding vegetation includes both Strandveld and Sand Fynbos elements. This contrasts with the shorter, rounded, bushier habit of *Heterorhachis aculeata*, mostly up to ± 500 mm high, which favours seasonally damp or waterlogged, loamy sand flats, at altitudes ranging from 100 m to about 800 m.

Heterorhachis hystrix has been Red listed as Critically Endangered (Raimondo *et al.* 2009) and although *H. aculeata* is substantially more widespread (Figure 14), at least three of the seven known populations have suffered partial or total loss of habitat in the last thirty years, and it is consequently Red listed as Vulnerable (Raimondo *et al.* 2009).

Other specimens seen

WESTERN CAPE.—3218 (Clanwilliam): near (east of) Graafwater, (–BA), 2 September 1938, *Salter 7551* (BOL); Graafwater, 18 August 1966, *Barker 10421* (NBG); ± 5 m S of Graafwater, Buroskraal Farm, 180 m, (–BA), 23 August 2006, *Helme 4284* (NBG). Without precise locality: Clanwilliam Flower Show, 27 August 1998, *Hanekom 3058* (PRE).

ACKNOWLEDGEMENTS

BOL, NBG, PRE and SAM, the main herbaria with good representation of collections of Cape species, were consulted for records of the two new species (herbarium acronyms after Holmgren *et al.* 1990). We thank curators of the above herbaria for allowing access to their collections. Michelle Smith kindly prepared the electronic figures.

REFERENCES

BREMER, K. 1994. *Asteraceae, cladistics and classification*. Timber Press, Portland, Oregon.
EHRHART, J.F. 1788. *Beiträge zur Naturkunde* 3. Schmidtische Buchhandlung, Hannover & Osnabrück.
FUNK, V.A. & R. CHAN. 2008. Phylogeny of the spiny African daisies (Compositae, tribe Arctotideae, subtribe Gorteriinae) based on *trn*L-F, *ndh*F, and ITS sequence data. *Molecular Phylogenetics and Evolution* 48: 47–60.
GOLDBLATT, P. & MANNING, J.C. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9. National Botanical Institute, Cape Town & Missouri Botanical Garden, St. Louis.
HOLMGREN, P.K., HOLMGREN, N.H. & BARNETT, L.C. 1990. *Index herbariorum, Part 1: the herbaria of the World*. New York Botanical Garden, New York.
KARIS, P.O., FUNK, V.A., MCKENZIE, R.J., BARKER, N.P. & CHAN, R. 2009. Arctotideae. In V.A. Funk, A. Susanna, T. Stuessy, & R. Bayer, *Systematics, evolution and biogeography of Compositae*: 285–310. IAPT, Vienna, Austria.
RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C., KAMUNDI, D.A. & MANYAMA, P.A. (eds). 2010. Red List of South African plants 2009. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.
ROESSLER, H. 1959. Revision der Arctotideae-Gorteriinae (Compositae). *Mitteilungen der Botanischen Staatssammlung München* 3: 71–500.

J.C. MANNING*, P.O. KARIS**, P. GOLDBLATT+ and N.A. HELME•

---

* Compton Herbarium, South African National Biodiversity Institute, Private Bag X7, 7735 Claremont, Cape Town.
** Department of Botany, Stockholm University, SE- 106 91, Stockholm, Sweden.
+ B.A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, USA.
• P.O. Box 22652, 7975 Scarborough, South Africa.
MS. received: 2009-10-20.

POACEAE

A NEW SPECIES OF *PENTAMERIS* FROM JONASKOP, SOUTH AFRICA

INTRODUCTION

The genera *Pentameris* P.Beauv., *Prionanthium* Desv. and *Pentaschistis* (Nees) Spach have received much attention in the last two decades.

Pentaschistis was revised by Linder & Ellis (1990), who recognised 68 species from the whole of Africa and Madagascar, as well as the Indian Ocean island of Amsterdam. Subsequently, Sylvia Phillips investigated the taxonomically very complex species-groups from the tropical African mountains (Phillips 1986, 1994, 1995a, b), and Chloé Galley described three new species from the southwestern Cape of South Africa (Galley & Linder 2006). At the moment, the authors recognize 73 species, and six infraspecific taxa. However, this number may need correcting, as the species delimitation in the difficult *P. pallida* group may need revising, and the current resolution of the *P. pictigluma* group may also not be optimal.

Pentameris was revised by Nigel Barker (1993), and *Prionanthium* by Gerrit Davidse (1988). During a recent field trip in South Africa, the first author located yet another new species, indicating that there may well still be even more undiscovered species, especially in the species-rich and topographically complex mountains of the Cape Floristic Region.

Recent molecular phylogenetic work (Barker *et al.* 2007; Pirie *et al.* 2008) has indicated that these three genera are phylogenetically intermingled. It is evident that the generic delimitations, especially of *Rytidosperma* sensu Clayton & Renvoize (1986), cannot be resolved with local analyses. This research has already revealed the existence of several groups of genera within the Danthonioideae (Barker *et al.* 2000, 2007). A detailed phylogenetic analysis of *Pentaschistis* (Galley & Linder 2007) revealed that the genus is paraphyletic relative to *Pentameris* and *Prionanthium*. As a result, we will include *Pentaschistis* within *Pentameris* (Linder *et al.* in press). Consequently, the new species is described in the genus *Pentameris*.

Pentameris ellisii *H.P.Linder*, sp. nov.

A *Pentaschistis barbata* foliis involuto, columna aristae limbum aequans, et indumento lemmatis differt.

TYPE.—Western Cape, 3319 (Worcester): Jonaskop, 33° 56.318' S, 19° 31.153' E, 970 m, (–DC), 24 January 2008, *H.P. Linder 7898* (Z, holo.; K, PRE, BOL, MO).

Plants perennial, caespitose, without stolons or rhizomes. *Culms* glabrous, straight, with 8 nodes, 400–600 mm tall; basal sheaths pale, glabrous; culm bases not swollen; prophylls bilobed, upper margin bristly, keels remaining parallel, scaberulous, extended up to 0.5 mm long, scaberulous awns; innovation buds intravaginal. *Leaves* cauline; ligule ciliate, simple, 0.3–0.5 mm long; sheath mouth villous (along the converging upper sheath margins); leaf blades 50–150 × 0.5–0.7 mm, very sparsely long-villous, rolled, apically blunt, soft-tipped. *Inflorescence* with 50–100 spikelets, widely paniculate, obliquely ovate to linear-lanceolate, 50–100 × 40–60 mm; internodes and pedicels longer than spikelets, glabrous, densely set with multicellular glands; nodes villous. *Spikelets* 2-flowered, all florets bisexual. *Glumes* both similar, 5.5–6.0 × ± 2 mm, acute to acuminate, glabrous, base and most of back purple, upper marginal areas yellow-green, central nerve well developed, densely set with multicellular glands, lateral nerves 2, poorly developed, overtopping florets. *Callus and rachilla* internode less than 3 mm long, junction oblique, two lateral hair tufts overtopping base of lemma, callus rounded. *Lemmas* 2.5–2.8 mm long, chartaceous, backs smooth, dull, with 9 veins, sparsely villous between keel and first set of nerves; shape of lemma lobes acute, 0.25–0.30 mm long, outer margins villous; setae 2.0–2.5 mm long, exserted from glumes, fused to inner margin of lemma lobes; awn 7–8 mm long, differentiated into a tightly corkscrewed column 3.4–4.5 mm long, and a scaberulous limb 3.5–4.5 mm long. *Palea* linear, ± 3 mm long, slightly overtopping lemma sinus, 0.3–0.5 mm wide, apically rounded to truncate, ciliate, otherwise totally glabrous; keels parallel, scarcely reaching palea apex. *Lodicules* 2, glabrous, cuneate, with 1 or 2 veins. *Anthers* yellow, 3 mm long. *Ovary* stalked, glabrous, style bases separated by a small indented outgrowth. *Flowering time*: January. Figure 18.

Etymology: the specific epithet honours Roger Ellis, who worked for many years at the Botanical Research Institute, Pretoria, and published extensively on the southern African grasses.

Diagnostic characters and relationships: the affinities of this species are obscure, as it shows diverse morphological relationships. The presence of glands, the size of the spikelet, and the inflorescence structure suggest an affinity to *Pentameris barbata* (Nees) Steud. However, the species differs by the position of the glands (absent from the leaves, present on pedicels and glumes), by the rolled leaves, by the awns with the column equalling the limb, and by the sparse indumentum on the lemma. In general appearance there is a similarity to *P. tortuosa* (Trin.) Nees, with which it shares the dark colour of the spikelets and the rolled leaves, but it differs by the presence of glands and by the generally smaller florets (as well as numerous other attributes). The growth form suggests an affinity to the common *P. colorata* (Steud.) Galley & H.P.Linder, ined., but the small, numerous spikelets and the presence of glands offer a distinction.

Distribution and ecology: this species is known from a single collection from the northern slopes of Jonaskop, where it was collected at 970 m on shallow soils over sandstone, in young fynbos (± 10 yrs after fire) with *Protea neriifolia*, in well-drained soil. Despite the late season, the population was in full flower. The species was common in the area, and was very distinctive by the open, dark-coloured inflorescences.

ACKNOWLEDGEMENTS

I would like to thank the Claraz Foundation for funding the field work, and CapeNature for the collecting permits.

REFERENCES

BARKER, N.P. 1993. A biosystematic study of *Pentameris* (Arundineae, Poaceae). *Bothalia* 23: 25–47.

BARKER, N.P., GALLEY, C., VERBOOM, G.A., GILBERT, M. & LINDER, H.P. 2007. The phylogeny of the austral grass subfamily Danthonioideae: evidence from multiple data sets. *Plant Systematics and Evolution* 264: 135–156.

BARKER, N.P., MORTON, C.M. & LINDER, H.P. 2000. The Danthonieae: generic composition and relationships. In S.W.L. Jacobs & J. Everett, *Grasses: systematics and evolution*: 221–230. CSIRO, Melbourne.

CLAYTON, W.D. & RENVOIZE, S.A. 1986. *Genera graminum. Grasses of the world.* Her Majesty's Stationary Office, London.

DAVIDSE, G. 1988. A revision of the genus *Prionanthium* (Poaceae: Arundinae). *Bothalia* 18: 143–153.

GALLEY, C. & LINDER, H.P. 2006. New species and taxonomic changes within *Pentaschistis* (Danthonioideae, Poaceae) from Western Cape, South Africa. *Bothalia* 36: 157–162.

GALLEY, C. & LINDER, H.P. 2007. The phylogeny of *Pentaschistis* (Danthonioideae, Poaceae) based on cpDNA, and the evolution and loss of complex characters. *Evolution* 61: 864–884.

LINDER, H.P., BAEZA, C.M., BARKER, N.P., GALLEY, C., HUMPHREYS, A.M., LLOYD, K.M., ORLOVICH, D.A., PIRIE, M.D., SIMON, B.K., WALSH, N.G. & VERBOOM, G.A. In press. A taxonomic classification of the Danthonioideae (Poaceae). *Annals of the Missouri Botanical Garden.*

LINDER, H.P. & ELLIS, R.P. 1990. A revision of *Pentaschistis* (Arundineae: Poaceae). *Contributions from the Bolus Herbarium* 12: 1–124.

PHILLIPS, S.M. 1986. Four new grasses from North East tropical Africa. *Kew Bulletin* 41: 1027–1030.

PHILLIPS, S.M. 1994. Variation in the *Pentaschistis pictigluma* complex (Gramineae). In J.H. Seyani & A.C. Chikuni, *Proceedings of the XIII Plenary Meeting of AETFAT, Zomba, Malawi, 2–11*

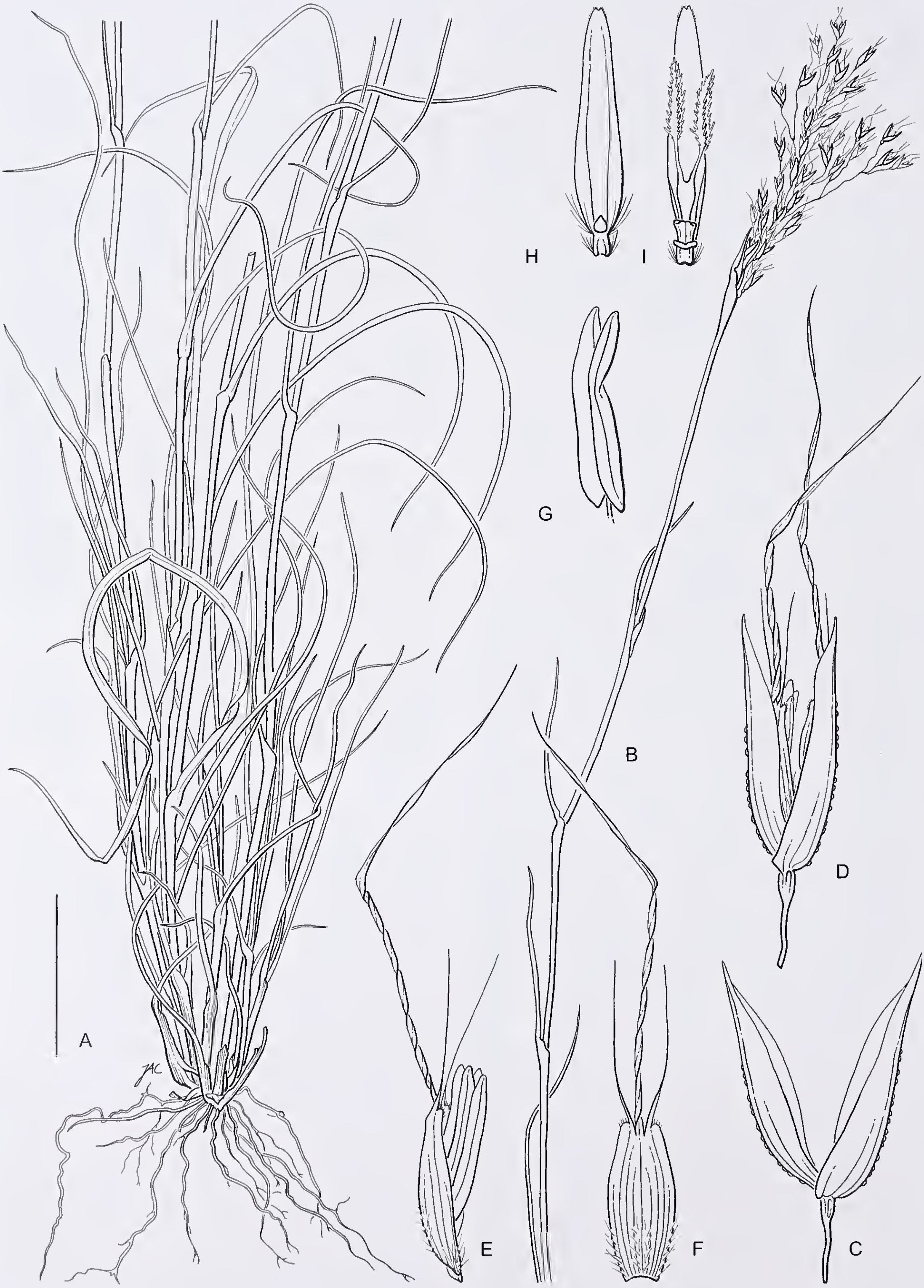


FIGURE 18.—*Pentameris ellisii*, *Linder 7898*: A, several tillers; B, portion of inflorescence; C, glumes; D, spikelet; E, floret from side; F, lemma from back; G, anther; H, palea from back with callus; I, palea from front, showing lodicules and gynoecium. Scale bar: A, B, 30 mm; C, D, 2.5 mm; E–I, 4 mm. Artist: Jasmin Baumann.

April 1991: 359–372. National Herbarium and Botanic Gardens of Malawi, Zomba.

PHILLIPS, S.M. 1995a. A new species of *Pentaschistis* (Gramineae) from Ethiopia. *Kew Bulletin* 50: 615–617.

PHILLIPS, S.M. 1995b. Poaceae (Gramineae). In I. Hedberg & S.V. Edwards, *Flora of Ethiopia and Eritrea*: 1–420. The National Herbarium, Addis Ababa University, Addis Ababa.

PIRIE, M.D., HUMPHREYS, A.M., GALLEY, C., BARKER, N.P., VERBOOM, G.A., ORLOVICH, D., DRAFFIN, S.J., LLOYD, K., BAEZA, C.M., NEGRITTO, M., RUIZ, E., COTA, J.H.S., REIMER, E. & LINDER, H.P. 2008. A novel supermatrix approach improves resolution of phylogenetic relationships in a comprehensive sample of danthonioid grasses *Molecular Phylogenetics and Evolution* 48: 1106–1119.

H.P. LINDER*

---

* Institute of Systematic Botany, University of Zurich, Zollikerstrasse 107, CH-8008 Zurich, Switzerland.

MS. received: 2010-03-04.

ASTERACEAE

SENECIO COMPTONII AND *S. ESTERHUYSENIAE*, TWO NEW SPECIES OF *SENECIO SENS. LAT.* (SENECIONEAE) FROM THE CAPE FLORISTIC REGION

Senecio L. *sens. lat.*, with ± 3 000 binomials, thus making it one of the largest genera of flowering plants (Nordenstam 2007), is clearly not monophyletic as presently circumscribed. Recent circumscriptions of *Senecio* treat it as a cosmopolitan genus of ± 1 250 spp., with concentrations of species in South America and southern Africa, where some 300 taxa are known (Herman *et al.* 2000; Welman 2003). Current opinion favours a narrower circumscription of the genus (Pelser *et al.* 2007) but final resolution and formalization of a new classification requires considerable further sampling to place all species in a new generic framework. Until then it is necessary to work with a broader circumscription of the genus.

Senecio is one of the ten largest genera in the Cape Floristic Region (CFR), with over 110 species recorded from the region (Goldblatt & Manning 2000), including four unnamed taxa. Two of these, *S. speciosissimus* J.C.Manning & Goldblatt and *S. umbricola* Cron & B.Nord., have since been described (Manning & Goldblatt 2005; Cron & Nordenstam 2009) and here we describe a further two species from the CFR: *S. esterhuyseniae*, which was included in *Cape plants* as *S.* sp. 1, and *S. comptonii*, misidentified there as *S. petiolaris* DC. (Goldblatt & Manning 2000). Collections at BOL, NBG, PRE and SAM, the main herbaria with good representation of collections of Cape species, were consulted for records of the two new species (herbarium acronyms after Holmgren *et al.* 1990).

Senecio comptonii *J.C.Manning & Goldbatt*, sp. nov.

Herba perennis subglabra usque ad 0.5 m, rhizomate brevi horizontali, caulibus simplicibus erectis infra foliaceis. Folia basaliter congesta superne in bracteas foliaceas dispersas transientia, petiolata, in axillis dense pubescentia, lamina subglabra vel trichomatibus multicellularibus effusis dispersis vestita, glauca infra purpurea, oblanceolate vel ovata vel obovata usque orbiculare, (15–)20–40 × 12–35 mm, apice obtusa, basi cuneata vel truncata, marginibus grosse et leniter calloso-serratis. Capitula discoidea homogama in caule pedunculato solitaria, involucro turbinato 10–12 mm diam. ecalyculato, phyllariis 8 ad 10 oblongis 10–12 × 2–3 mm. Flosculi numerosi flavi 12–15 mm longi corollae lobis adaxialiter papillatis in dimidio distali, ovario ± cylindrico 10-nervoso glabro praeter trichomata duplicia ad basem, pappo in omnibus flosculis praesente, setis numerosis flosculos ± aequantibus uniseriatis basi connatis barbellatis persistentibus.

TYPE.—Western Cape, 3219 (Wuppertal): Kromme River, 2500' [1 500 m], (–CB), 27 September 1934, *Compton 5125* (NBG, holo.).

Herbaceous, subglabrous perennial up to 0.5 m, with short, horizontal rhizome, sometimes slightly swollen but not evidently tuberous, bearing ± thickened, cylindrical roots 1–2 mm diam.; stems erect or shortly decumbent at base, 1.5–2.0 mm diam., simple, leafy below, pedunculate above, slightly ribbed, dying back after flowering. *Leaves* crowded basally, passing abruptly into scattered, leaf-like bracts above; foliage leaves suberect to ascending, brittle or subsucculent, subglabrous but with scattered, patent, multicellular, flagelliform hairs on margins of petioles near base and adaxially, especially along midrib, and with tufts of silky hairs in leaf axils, glaucous, purple beneath with raised midrib, petiolate; blade ovate, oblanceolate or obovate to orbicular, (15–)20–40 × 12–35 mm, obtuse, base cuneate or truncate, margins thin-textured or slightly cartilaginous and often slightly revolute, coarsely and weakly callose-serrate with 5–10 teeth per side; petiole 15–45 mm long, weakly decurrent. *Capitula* discoid, homogamous, solitary on pedunculate stem; bracts lax, sessile, lanceolate, largest up to 20 × 5 mm, becoming smaller acropetally, erect and stem-clasping at base, margins fimbriolate distally. *Involucre* turbinate, 10–12 mm diam., without bracteoles; phyllaries uniseriate, 8–10, oblong, 10–12 × 2–3 mm, free to base, acute, ciliate-penicillate, inner edges with membranous, ciliolate margins, with 3–7 dark red, resinous veins; receptacle ± 3 mm diam. *Florets* numerous, yellow, 12–15 mm long; lower part of corolla cylindrical, ± 5 mm long, expanding gradually and evenly into limb, limb obconic, ± 5 mm long, 5-lobed; lobes triangular, ± 1.0 × 0.7 mm, papillate adaxially in distal half, with resinous submarginal and median veins. *Anthers* ± 2.8 mm long including ovate apical appendage; base sagittate; filament collar balusterform. *Ovary* ± cylindrical, 3.5–4.5 mm long, 10-ribbed, glabrous but base puberulous with short twin hairs; style terete with swollen base, branching ± 1 mm beyond mouth of tube at base of anther appendages, exserted ± 1 mm, branches ± 2 mm long, margins stigmatic, apices truncate with crown of papillae and fringe of sweeping hairs. *Cypselas* unknown. *Pappus* present in

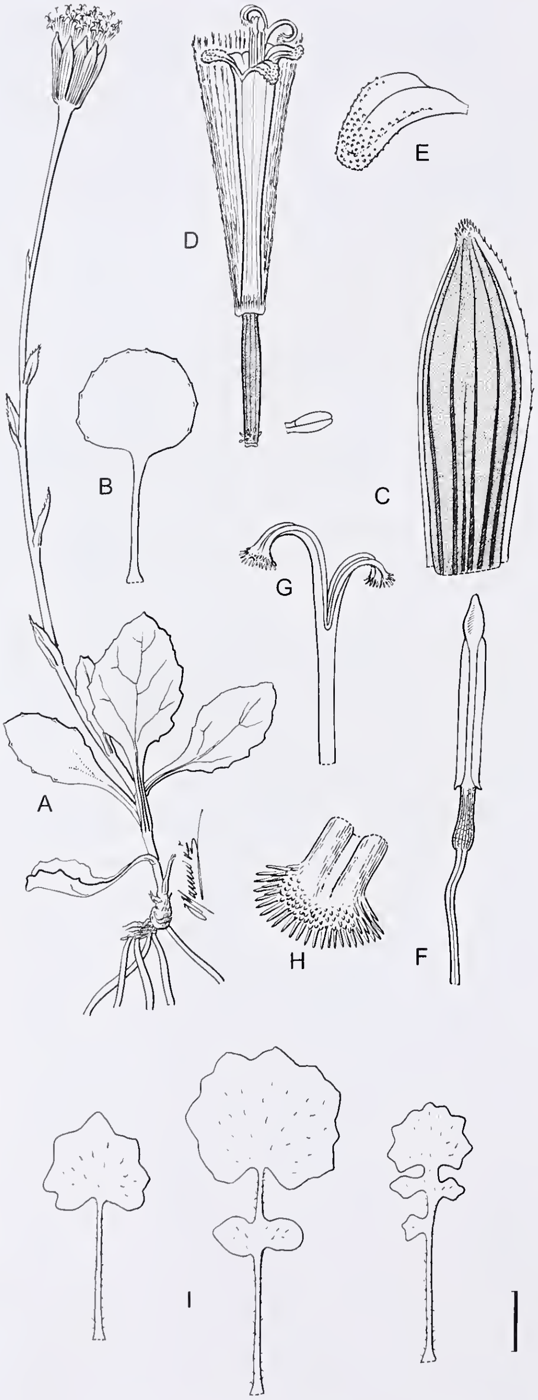


FIGURE 19.—*Senecio comptonii.* A, *Compton 5125*: whole plant. B–H, *Compton 21141*: B, leaf; C, phyllary; D, floret (pappus removed from front), including detail of twin hair (much magnified); E, detail of petal lobe; F, single stamen; G, style branches; H, detail of style branch apex. I, *Senecio incertus*: leaf variation. Scale bar: A, B, I, 10 mm; C, D, 2 mm; E–G, 1 mm; H, 0.5 mm. Artist: John Manning.

all florets, bristles uniseriate, numerous, 10–13 mm long, exceeding corolla tube and ± as long as florets, connate basally, white, barbellate, persistent. *Flowering time*: late September to November. Figure 19.

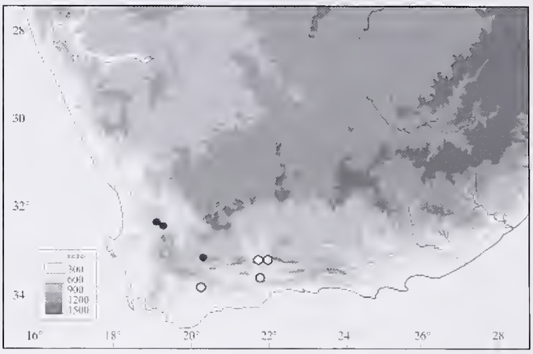


FIGURE 20.—Known distribution of *Senecio comptonii*, ●; and *S. esterhuyseniae*, ○.

Distribution and ecology: apparently restricted to the drier southwestern mountains on the inland fringes of the Cape Floristic Region, where it has been recorded from the eastern Cedarberg and the Witteberg (Figure 20).

Just three collections of *Senecio comptonii* are known. The two earlier ones were both made by R.H. Compton, Director of the National Botanical Gardens in South Africa 1919–1953, who determined them as an unnamed species of *Doria* (the genus to which discoid flowered members of *Othonna* were traditionally referred) and for whom we name the species.

Diagnosis and relationships: the perennial habit with short, rhizomatous rootstock and ± thickened, cylindrical roots, the subsucculent, petiolate lower leaves, and the almost naked peduncles with discoid capitula suggest a close relationship with *Senecio incertus* DC. [previously known under the illegitimate homonym, *S. tuberosus* (DC.) Harv.] in *Senecio* sect. *Paucifolii* Harv. (1865) but the two species differ in several vegetative and floral respects.

Senecio incertus has more variably dissected leaves, either lyrate-pinnatisect or simple, and coarsely dentate with the margins more evidently revolute. Either the whole blade (when simple) or at least the uppermost lobe (when pinnatisect) is suborbicular-reniform and ± cordate (Figure 19I), and the leaves, especially the lower surface, are more densely pubescent with distinctive, flagelliform hairs. The peduncles are simple or more often sparsely branched, with up to seven capitula, and the florets are white or brownish to greenish, with distinctive beaked, striate-hispidulous ovaries. The rootstock is a small, subglobose tuber from which the annual stems arise. *S. incertus* has been recorded from the Pakhuis Mountains southwards through the Cold Bokkeveld to the Riviersonderend Mountains and Swellendam, where it occurs in moist places among rocks on southerly slopes, thus favouring more mesic situations than *S. comptonii*. The capitula in *S. incertus* are strongly and pleasantly fragrant but this feature is unrecorded in *S. comptonii*. Both species have been recorded from the Cedarberg.

The molecular analysis of Pelser *et al.* (2007) locates *Senecio oxyriifolius* DC. [initially treated in *Senecio* sect. *Paucifolii* by Harvey (1865) but later transferred to sect. *Peltati* (Muschl.) C.Jeffrey (Jeffrey 1986)] in subtribe Senecioninae among a group of succulent, mainly African species comprising their Gynuroid clade, thus outside *Senecio s. str.* The genera *Gynura* Cass., *Kleinia* Mill. and *Solanecio* (Sch.Bip.) Walp. form a well-supported clade within this group but resolution is poor among the remaining members, which comprise primarily *Senecio* sections *Peltati*, *Kleinioidei* DC. and *Rowleyani* C.Jeffrey (Jeffrey 1986). The corolla lobes of *S. comptonii, S. incertus* and *S. oxyriifolius* are papillate abaxially and although the relationships of *S. comptoniii* and *S. incertus* may well lie here, this requires confirmation.

Senecio sect. *Rowleyani* has been raised to generic level as the genus *Curio* P.V.Heath (Heath 1997) but relationships in the group are still too poorly resolved at present to justify this step.

Additional material seen

WESTERN CAPE.—3219 (Wuppertal): Cederberg, Gonnafontein, 900 m, (–CB), 7 October 2000, *Pond 268* (NBG). 3320 (Montagu): Witteberg, S slope, 4000' [2 500 m], (–BC), 7 November 1948, *Compton 21141* (NBG).

Senecio esterhuyseniae *J.C.Manning & Goldblatt*, sp. nov.

Suffrutex glaber usque ad 0.6 m, caulibus gracilibus virgatis ex caudice lignoso. Folia caulina sessilia suberecta semi-teretia ± triangularia in sectione transversali, (15–)30–40 × 1–2 mm, apiculata, coriacea. Capitula discoidea homogama, aliquot usque multa in paniculam laxe divaricatam ramis nudis filiformibus disposita, involucro turbinato 3–4 mm diam. calyculo extenso bracteolis subulatis congestis imbricatis usque ad 10 subtento, phyllariis 5 vel 6(7) oblongis 6.0–6.6 × 1–2 mm. Flosculi 7 ad 10(–12), cremei, ± 7 mm longi. Cypselae ellipsoideae ± 2.8 × 1.0 mm obscure ± 10-costatae omnino dense adpresso-pubescentes nigrae, pappo in omnibus flosculis praesente, setis numerosis uniseriatis albis barbellatis, persistentibus, 3.0–3.5 mm longis.

TYPE.—Western Cape, 3321 (Ladismith): S slopes of Swartberg below Towerkop, 3000–5000' [1 875–3 125 m], (–AC/D), 23 April 1951, *Esterhuysen 18538* (BOL, holo.; NBG, iso.).

Suffrutex up to 0.6 m, resprouting after fire, with slender, rod- or wand-like stems from woody rootstock, glabrous; stems erect or decumbent, slightly ribbed, 1–2 mm diam., green, simple below inflorescence branches, dying back to near base after flowering. *Leaves* cauline, sessile, suberect to ascending, subsecund on inclined stems, semi-terete, ± triangular in section, appearing canaliculate adaxially when dry, (15–)30–40 × 1–2 mm, lax or imbricate, apiculate, leathery, weakly decurrent, without evident veins, passing abruptly into inflorescence bracts. *Capitula* discoid, homogamous, several to many in laxly divaricate panicle with leafless, wiry branches, sometimes with smaller secondary inflorescences from axils of uppermost leaves forming ovoid or corymbose synflorescence, ultimate branchlets 5–15 mm long, erect or spreading but then sharply upcurved apically so that capitulae borne erect; bracts subulate, 1–3 mm long. *Involucre* turbinate, 3–4 mm diam., with up to 10 subulate bracteoles crowded immediately below capitula in extended, imbricating calyculus; phyllaries uniseriate, 5 or 6(7), oblong, 6.0–6.6 × 1–2 mm, free to base, acute, ciliate-penicillate, inner edges broadly membranous; margins ciliolate, green or suffused reddish apically, with three dark red, resinous veins; receptacle ± 2 mm diam. *Florets* 7–10(–12), cream-coloured, ± 7 mm long; corolla glabrous, lower part cylindrical, ± 2 mm long, expanding ± abruptly into limb, limb narrowly campanulate, ± 3.5 mm long, 5-lobed; lobes triangular, ± 1 × 0.7 mm, with resinous submarginal and median veins. *Anthers* 2.5 mm long including ovate apical appendage; base tailed; filament collar balusterform. *Ovary* ellipsoid, 2.5 mm long, densely pubescent; style terete with swollen base, branching below mouth of tube, scarcely exserted, ± as long as anthers, branches ± 1 mm long, lateral margins stigmatic, apices truncate with crown of papillae. *Cypselas* ellipsoid, 2.8 × 1 mm, obscurely ± 10-ribbed but densely adpressed-pubescent throughout, black. *Pappus* present in all florets, bristles numerous, uniseriate, 3.0–3.5 mm long, ± reaching top of corolla tube, white, barbellate, persistent. *Flowering time*: throughout the year. Figure 21.

Distribution and ecology: restricted to the mountains fringing the western Little Karoo (Figure 20) and evidently uncommon, *Senecio esterhuyseniae* has been collected most often on the southern slopes of the Klein Swartberg near Ladismith and from the summit of the Rooiberg south of Calitzdorp but has also been recorded along the lower northern slopes of the Langeberg east of Montagu. Collector's notes on several sheets remark on the relative scarcity of the species, reporting just one or a few plants at each locality. The species appears to favour cooler, usually south-facing rocky sandstone slopes, sometimes in seasonally moist situations, and has mostly been collected in flower after fire, usually between March and September, but this may merely reflect increased collecting activity in response to such conditions. Fruiting capitula that we have examined set at most 2–4 cypselas, possibly a function of the relatively large size of the cypselas compared to the receptacle.

Diagnosis and relationships: *Senecio esterhuyseniae* is readily recognized as a re-sprouting suffrutex with needle-like leaves and slender, wand-like stems terminating in open, wiry panicles of discoid, white-flowered capitula. The capitula are turbinate, 6.0–6.5 × 3–4 mm, with only 5 or 6(7) relatively broadly oblong phyllaries, and are subtended by an extended series of imbricating bracteoles running down the branchlets for some distance below the capitula.

The relationships of *Senecio esterhuyseniae* are not clear. In its extended calyculus and discoid capitula with few phyllaries, the species bears a passing resemblance to two southwestern Cape members of Harvey's (1865) sect. *Leptolobi*, *S. bipinnatus* Less. and *S. foeniculoides* Harv., but both these species have bipinnatisect leaves and dense corymbs of yellow capitula with distinctive glabrous cypselas, quite unlike the ellipsoid, densely pubescent cypselas of *S. esterhuyseniae*. Final resolution of its position within the tribe will benefit from molecular study.

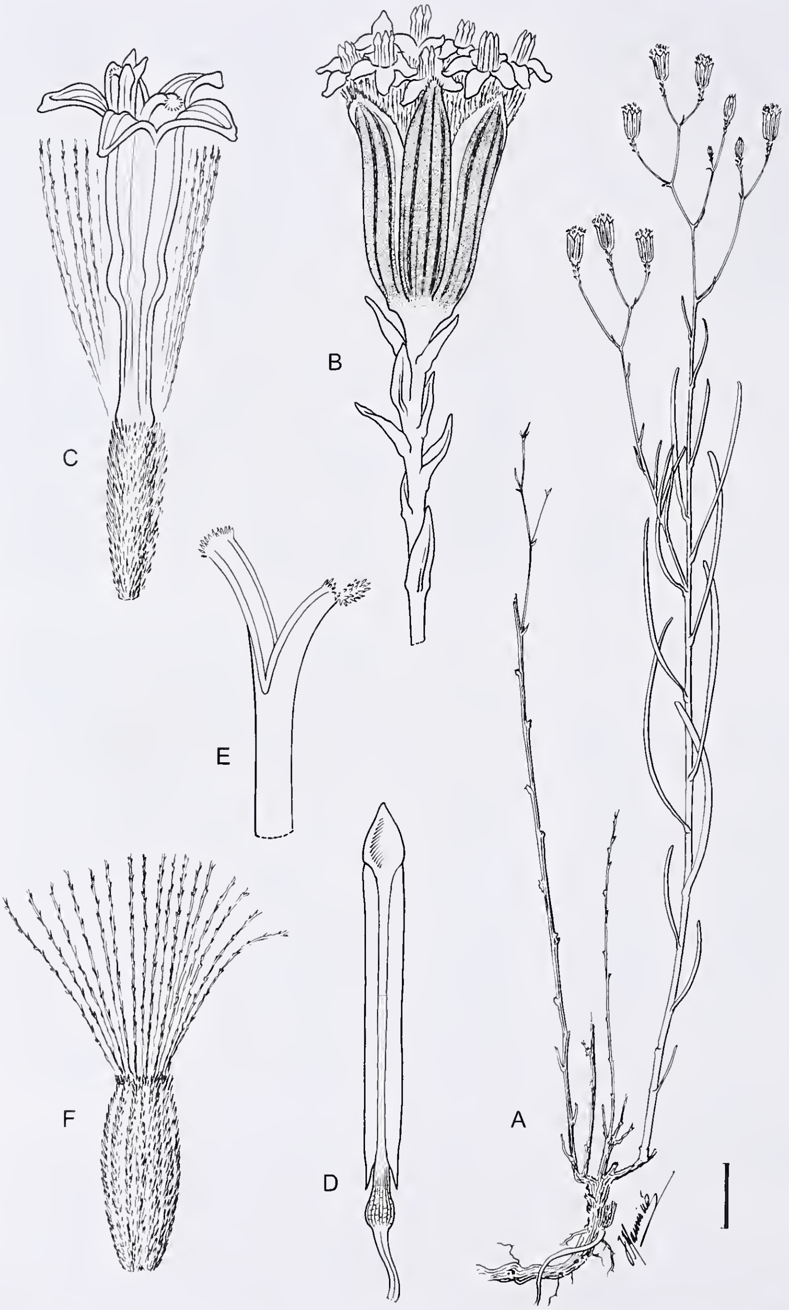


FIGURE 21.—*Senecio esterhuyseniae.* A, *Esterhuysen 17513*: whole plant. B–F, *Helme 5440*: B, capitulum; C, floret (pappus removed from front); D, single stamen; E, style branches; F, cypsela. Scale bar: A, 20 mm; B, 2 mm; C, F, 1 mm; D, E, 0.4 mm. Artist: John Manning.

Although first collected in 1937 and 1941 by Cape Town botanist Margaret Levyns, most of our knowledge of the species is due to the activities of Elsie Esterhuysen, who collected it on several occasions. Miss Esterhuysen was well aware that her collections represented a novelty, often making detailed field notes on her labels, and it is unfortunate that she did not live to see it named. It is only fitting that she is remembered in the epithet.

Other material seen

WESTERN CAPE.—3320 (Montagu): slopes at foot of Langeberg near Leeurivierberg, (–CD), 4 September 1955, *Esterhuysen 24584* (BOL); N slopes of Langeberg between Leeurivierberg and Misty Point, 3000–4000' [1 875–2 500 m], (–CD), 1 September 1978, *Esterhuysen 35003* (BOL); lower rocky slopes of Langeberg at Burgersvlei south of Misty Point, (–CD), 31 August 1968, *Esterhuysen 31984* (BOL); N side of Langeberg above Rietrivier north of Leeurivierberg, (–CD), 26 April 2008, *Helme 5440* (NBG). 3321 (Ladismith): Ladismith, on koppie, growing in another shrub, 2100' [1 312 m], (–AD), 8 July 1941, *Levyns 7439* (BOL); Swartberg near Ladismith, (–AD), 30 May 1954, *Esterhuysen 22927* (BOL); slopes below Towerkop, S side, ± 5000' [3 125 m], (–AD), 30 March 1964, *Esterhuysen 30673* (BOL, PRE); Seven Weeks Poort Berg, stony S slopes, ± 4000' [2 500 m], (–AD), 13 April 1979, *Esterhuysen 35202* (BOL); Roodeberg [Rooiberg], on top, (–CB), 6 July 1937, *Levyns 6084* (BOL); S slopes of Roodeberg [Rooiberg], (–CB), 24 May 1950, *Esterhuysen 17153* (BOL, NBG, PRE); Rooiberg, west of Bailey's Peak, ± 4100' [2 562 m], (–CB), 17 April 1977, *Taylor 9598* (NBG, PRE).

ACKNOWLEDGEMENTS

We thank the curators of BOL, NBG, PRE and SAM for allowing us access to their collections. Michelle Smith kindly prepared the electronic figures.

REFERENCES

CRON, G. & NORDENSTAM, B. 2009. *Senecio umbricola* (Asteraceae–Senecioneae), a new species from the Cederberg, South Africa. *South African Journal of Botany* 75: 246–248.

GOLDBLATT, P. & MANNING, J.C. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9. National Botanical Institute, Cape Town & Missouri Botanical Garden, St. Louis.

HARVEY, W.H. 1865. Compositae. In W.H. Harvey & O.W. Sonder, *Flora capensis* 3: 44–530. Hodges, Smith, Dublin.

HEATH, P.V. 1997. Three new generic names in Asteraceae (part 1). *Calyx* 5: 136.

HERMAN, P.P.J., RETIEF, E., KOEKEMOER, M. & WELMAN, W.G. 2000. Asteraceae (Compositae). In O.A. Leistner, Seed plants of southern Africa: families and genera. *Strelitzia* 10: 102–170. National Botanical Institute, Pretoria.

HOLMGREN, P.K., HOLMGREN, N.H. & BARNETT, L.C. 1990. *Index herbariorum. Part. 1: the herbaria of the World*. New York Botanical Garden, New York.

JEFFREY, C. 1986. The Senecioneae in East tropical Africa. Notes on Compositae IV. *Kew Bulletin* 41: 873–943.

MANNING, J.C. & GOLDBLATT, P. 2005. Two new species of Asteraceae from Northern and Western Cape, South Africa and a new synonym. *Bothalia* 35: 55–61.

NORDENSTAM, B. 2007. Tribe Senecioneae Cass. In J.W. Kadarait & C. Jeffrey, *The families and genera of vascular plants* VIII. Flowering plants: eudicots: 208–241. Springer, Berlin.

PELSER, P.B., NORDENSTAM, B., KADARAIT, J.W. & WATSON, L.E. 2007. An ITS phylogeny of tribe Senecioneae (Asteraceae) and a new delimitation of *Senecio* L. *Taxon* 56: 1077–1104.

WELMAN, W.G. 2003. *Senecio*. In G. Germishuizen & N.L. Meyer, Plants of southern Africa: an annotated checklist. *Strelitzia* 14: 282–293. National Botanical Institute, Pretoria.

J.C. MANNING* and P. GOLDBLATT**

---

* Compton Herbarium, South African National Biodiversity Institute, Private Bag X7, 7735 Claremont, Cape Town.

** B.A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, USA.

MS. received: 2009-10-20.

ASPHODELACEAE

BULBINELLA CALCICOLA, A NEW SPECIES FROM SALDANHA BAY, WESTERN CAPE

Bulbinella Kunth. is a small genus of rhizomatous geophytes with its primary centre of diversity in the winter rainfall region of southern Africa (17 spp.) and a secondary centre in New Zealand (6 spp.) (Smith & Van Wyk 1998; Perry 1999). This trans-Pacific disjunction places it among a handful of other geophytic genera with a similar distribution, namely *Dietes* (Iridaceae), *Wurmbea* (Colchicaceae), *Spiloxene* (Hypoxidaceae) and *Bulbine* (Asphodelaceae). *Bulbinella* is characterized among Asphodelaceae by its narrow racemes of long-lived, stellate flowers with a persistent perianth, smooth filaments, and a single pair of ovules per locule, developing into shield-shaped seeds.

The southern African species were comprehensively revised by Perry (1999), who emphasized the taxonomic value of vegetative features relative to floral and fruiting characters, which are almost invariant. She distinguished three groups of species based on a combination of foliage and root characteristics. The first, comprising the three largest species, is defined by distinctive orange-yellow roots thickened throughout their length, and leaves that diminish in size acropetally; a second group of six species, with the younger leaves markedly smaller than the older, has white-fleshed roots that are thin and wiry basally but swollen and spindle-shaped distally; and a third group, comprising the remaining eight species, is recognized by its ± equal leaves. The roots in this group, although always white, are variable in form, mostly swollen throughout but sometimes with some or all of the roots wiry basally and swollen distally. Flower colour in *Bulbinella* ranges from white or ivory through pale or deep yellow to orange. Although variable within the three allied species with yellow roots [*B. elata* P.L.Perry, *B. latifolia* Kunth., and *B. nutans* (Thunb.) T.Durand & Schinz], flower colour is almost consistent in the remaining species. With the exception of *B. elegans* Schltr. ex P.L.Perry, which varies between pale yellow and white, all remaining species have flowers that are either white or bright yellow but never both.

Intensive documentation of the local limestone flora at Jacobsbaai, north of Saldanha on the west coast by local resident Jakobus (Koos) Claassens, has resulted in the discovery of several new species endemic to the area (Manning & Goldblatt 2008). His most recent find is a summer-flowering *Bulbinella* that resembles *B. triquetra* (L.f.) Kunth in several respects, notably the numerous, trigonous leaves with finely toothed margins, coarsely fibrous neck, and pure yellow flowers. The Jacobsbaai plants are, however, distinctive in their more numerous, broader leaves, which are dry and withered by the time that the elongate, narrowly cylindrical racemes of orange-tipped, bright yellow flowers appear in late November and December. *B. triquetra* itself has not yet been recorded from the Saldhana Peninsula (Perry 1999) and our first consideration was that the Jacobsbaai plants might represent a form of this species. We are, however, familiar with *B. triquetra* from flushes on granite rocks a few kilometres across the bay at Langebaan, where it produces corymbose racemes of canary-yellow flowers in August and September, contemporaneous with tufts of filiform leaves (*Perry 3932* NBG; Manning & Goldblatt 1996). These characteristics are constant throughout other west coast populations of the species that we have examined, providing compelling evidence that the Jacobsbaai plants represent a distinct species which we describe here as *B. calcicola*.

Bulbinella calcicola *J.C.Manning & Goldblatt*, sp. nov.

Bulbinellae triquetrae maxime similis, sed ab ea foliis latioribus 1.5–2.0 mm latis siccis sub anthesi, racemo

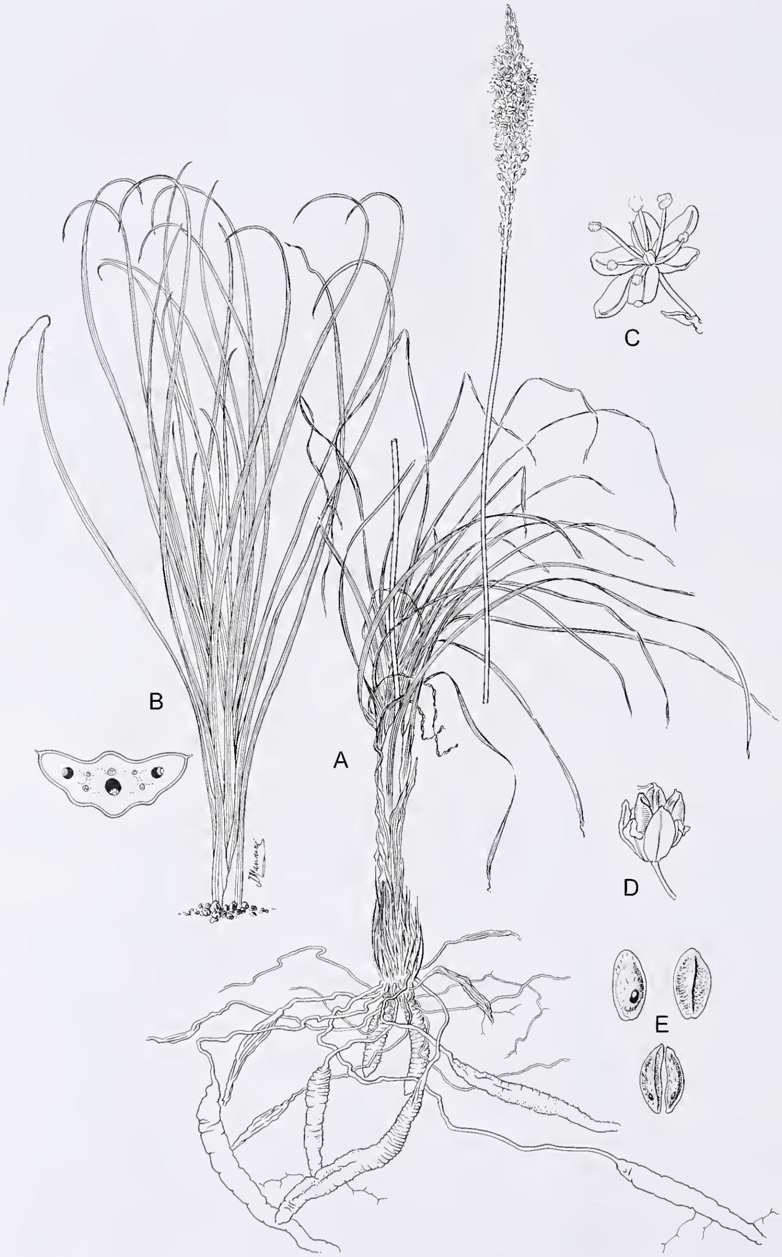


FIGURE 22.—*Bulbinella calcicola*, *Claassens & Claassens 11* (NBG). A, flowering plant with persistent dry leaves; B, foliage in winter, with t/s of leaf (much enlarged); C, flower; D, dehisced capsule; E, seeds. Scale bar: A, B, 10 mm; C–E, 3 mm. Artist: John Manning.

anguste cylindrico ± 10 mm diam., pedicellis brevioribus 3–4 mm longis et aestate florens distinguitur.

TYPE.—Western Cape, 3217 (Vredenburg): Jacobsbaai, (–DD), 8 December 2008, *J.G. & H.E. Claassens 11* (NBG, holo. ; K, MO, iso.).

Plants small to medium-sized, 300–500(–800) mm high, solitary. *Roots* fascicled, numerous, up to 180 mm long, some short and uniformly swollen but mostly with wiry basal portion and swollen, spindle-shaped distal section, 30–60 × 5–6 mm, flesh white to pale pink. *Leaves* dry at flowering, 20–50, ± subequal with only youngest, central leaves smaller, basal part expanded to form whitish, membranous sheath, outer leaf sheaths completely encircling inner leaves and scape; blade linear, up to 630 × 1.5–2.0 mm, slightly coiled or twisted distally, triquetrous in section with evident midrib on both surfaces when fresh but triquetrous-canaliculate when dry, bright green, glabrous or minutely ciliolate-denticulate on margins and keel; fibrous sheathing neck 20–30 mm long, of coarse, straight, loose, bristle-like fibres. *Raceme* cylindrical or narrowly conical, 50–150-flowered, ± 50 × 10 mm in flower but elongating up to 200 mm in fruit and then slightly inclined; scape erect, 1–2 mm diam., reddish; bracts membranous, triangular-acuminate, broad-based, 2–3 × 1.5–2.0 mm, colourless with reddish midrib; pedicels suberect, 3–4 mm long. *Flowers* stellate, 6–7 mm diam., bright yellow with greenish midrib and median orange streak near apex, slightly scented; tepals connate at base, elliptic-oblong, inner slightly broader, 3–4 × 1.5–2.0 mm. *Filaments* filiform, suberect, adnate to base of tepals,

TABLE 3.—Diagnostic characters in *Bulbinella calcicola* and *B. triquetra*

Character	*B. calcicola*	*B. triquetra*
Leaves	linear-canaliculate, 1.5–2.0 mm wide	filiform, 1.0–1.5 mm diam.
Ethology	hysteranthus	synanthus
Flowering time	Nov.–Dec.	Aug.–Oct.(–Dec.)
Raceme width	narrowly cylindrical, ± 10 mm	corymbose or cylindrical, 15–20 mm
Pedicel length	3–4 mm	5–8 mm
Perianth colour	yellow with orange tips	pure yellow
Habitat	limestone	granite, sandstone or clay

2.5–3.0 mm long, yellow. *Ovary* ovoid, ± 1 mm long, 3-lobed; style filiform, 1.5–1.8 mm long. *Capsule* ovoid, 3.0–3.5 × 2.0–2.5 mm, reddish brown, partially concealed by persistent, papery perianth. *Seeds* solitary or paired per locule, shield-shaped, slightly convex on outer surface but strongly keeled on inner surface, 3.0–3.5 × ± 1.8 mm when solitary but only ± 0.8 mm wide when paired, with narrow, membranous, peripheral wing, dull black with glossy spot (sarcotestal ostiole) on basal face, sarcotesta with radially scattered, pale idioblasts. *Flowering time*: late November to December. Figure 22.

Distribution and habitat: apparently restricted to Jacobsbaai north of Saldanha (Figure 23), where plants occur on rocky limestone outcrops in Saldanha Limestone Strandveld, a rare coastal vegetation type almost entirely limited to the Saldanha Peninsula and rich in Red Data species (Mucina & Rutherford 2006).

Indications are that the species is highly localized to a few calcrete outcrops in relatively open vegetation. The main population of ± 300 plants occupies an area ± 40 × 40 m in extent, with an additional three much smaller populations, comprising between 5 and 30 plants, within 500 m of the main group (J. Claassens pers. comm.).

Diagnosis and relationships: its numerous, ± subequal leaves place *Bulbinella calcicola* in Perry's (1999) third group of species, where it most resembles *B. triquetra*. *Bulbinella triquetra* is distinguished by its filiform leaves, 1.0–1.5 mm wide, sheathed by coarse, bristle-like fibres, contemporaneous with the corymbose to cylindrical raceme, 15–20 mm in diameter, of pure yellow flowers borne on longer pedicels, 5–8 mm long, and (in some populations) spindle-shaped roots with wiry basal parts (Table 3). *B. triquetra* is widespread through the south-western Cape, favouring seasonally damp flats and flowering mainly in spring, August to October but as late as December at higher altitudes. It is restricted to organic-rich sandy or clay soils, and has never been collected on limestone or calcrete (Perry 1999).

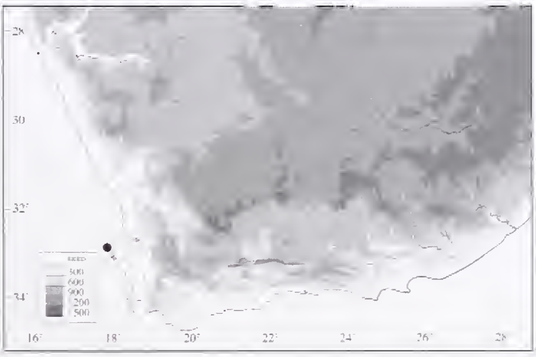


FIGURE 23.—Known distribution of *Bulbinella calcicola*.

Bulbinella calcicola, in contrast, produces broader, canaliculate leaves, 1.5–2.0 mm wide, that are dry and withered at flowering, and narrowly cylindrical racemes, ± 10 mm in diameter, of distinctly orange-tipped flowers on shorter pedicels 3–4 mm long. Flowering in the species, which grows near sea level, is delayed until late November and December, at the height of summer.

A similar morphological-temporal relationship appears to exist in another pair of species, *Bulbinella caudafelis* (L.f.) T.Durand & Schinz, which produces racemes ± 30 mm in diameter of pink-tipped flowers from late August to December, and *B. graminifolia* P.L.Perry, which produces narrower racemes ± 15 mm in diameter of pure white flowers from July to mid-August (Perry 1999).

Selected additional specimens examined

Bulbinella triquetra

WESTERN CAPE.—3318 (Cape Town): Langebaan, (–AA), 30 August 1995, *Perry 3932* (NBG); Darling Flora Reserve, (–AD), 4 October 1956, *Barker 8647, Lewis 5071* (NBG); Mamre Hills, (–AD), 26 September 1941, *Compton 11776* (NBG), 22 September 1942, *Barker 1823* (NBG); Ganzekraal, (–CB), 15 September 1940, *Compton 9447* (NBG); Rondebosch Common, (–CD), 7 September 1982, *Edwards s.n.* (NBG); Sewefontein above Kuilsrivier, (–DC), 2 October 1973, *Oliver 4735* (NBG).

REFERENCES

MANNING, J.C. & GOLDBLATT, P. 1996. *West coast*. Wild Flower Guide 7. Botanical Society of South Africa, Cape Town.

MANNING, J.C. & GOLDBLATT, P. 2008. *Tripteris calcicola* (Asteraceae), a new calciphilous species from Western Cape, South Africa. *Bothalia* 38: 85–88.

MUCINA, L. & RUTHERFORD, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

PERRY, P.L. 1999. *Bulbinella* in South Africa. *Strelitzia* 8. National Botanical Institute, Pretoria.

SMITH, G.F. & VAN WYK, B.-E. 1998. Asphodelaceae. In K. Kubitzki, *The families and genera of vascular plants*: 130–140. Springer, Berlin.

J.C. MANNING* and P. GOLDBLATT**

---

* Compton Herbarium, South African National Biodiversity Institute, Private Bag X7, 7735 Claremont, Cape Town.

** B.A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, USA.

MS. received: 2009-11-05.

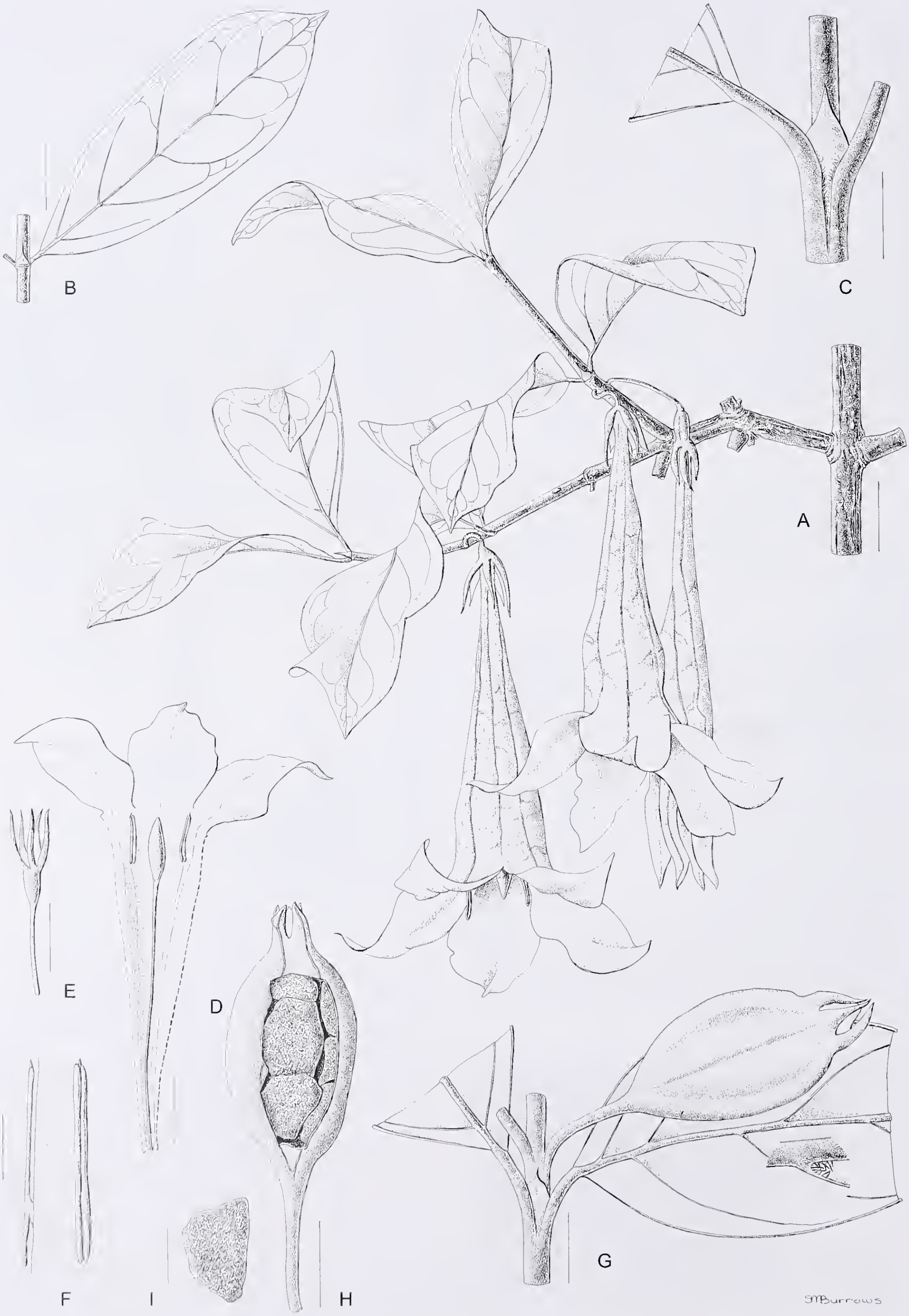


FIGURE 24.—*Didymosalpinx callianthus*. A–F, *Burrows & Burrows 10998*: A, flowering branch; B, leaf; C, stipule and petioles; D, flower with tube cut away; E, calyx; F, anther and anther attachment view. G–I, *Burrows & Burrows 11285*: G, fruiting branch; H, fruit, with seeds exposed; I, seed. Scale bars: A, B, D, E, 20 mm; G, H, 10 mm; C, F, I, 5 mm. Artist: Sandra Burrows.

RUBIACEAE

A NEW SPECIES OF *DIDYMOSALPINX* AND A NEW SPECIES OF *OXYANTHUS* FROM MOZAMBIQUE AND TANZANIA

Recent research into the flora of northeastern Mozambique has brought to light, from the Palma District of Cabo Delgado Province, two taxa of Rubiaceae which have yet to be described. Both these taxa have previously been recorded from the southeastern region of Tanzania but have only been known from a few specimens which lack either fruit or flower and have, therefore, remained un-named. Now that fruiting and flowering material of both these taxa has been collected from Mozambique, they are fully described below.

Didymosalpinx callianthus *J.E.Burrows & S.M.Burrows*, sp. nov., *D. norae* (Swynn.) Keay similis sed fruticex parvae usque ad 1 m altus, spinis nullis, lobis calycis maioribus 10–17 mm longis, floribus maioribus tubo corollae 75–85 mm longo differt.

TYPE.—Mozambique: Cabo Delgado Province, Palma District, 1.9 km from turnoff to Nhica do Rovuma on Palma-Pundanhar road, 10° 50' 55"S, 40° 12' 44"E, 140 m, 6 December 2008, *J.E. Burrows & S.M. Burrows 10998* (BNRH, holo.; K, LMA, PRE, iso.).

Didymosalpinx sp. A, Bridson & Verdcourt (1988: 526).

Woody, evergreen, glabrous shrub or treelet, 0.5–1 m tall, with 1–3 stems. *Branches* ± horizontal, spines absent. *Leaves* opposite, evenly spaced along branchlets, elliptic to broadly elliptic or oblanceolate, 65–130 × 25–50 mm, apex acuminate to apiculate, terminating in a fine mucro, base cuneate to broadly cuneate; margin entire, faintly rolled under, drying olivaceous, texture thinly coriaceous, shiny above, glabrous throughout, domatia absent or a few (1or 2 per leaf) scattered in axils of stronger lateral veins, small, set with short, silky hairs; stipules 4–6 × 3.0–3.5 mm, limb broadly triangular with a narrow acumen 3–4 mm long, inner surface glabrous. *Flowers* pendulous, paired or single, arising 5–10 mm above leaf node; pedicel 20–28 mm long, glabrous. *Calyx*: limb broadly obconic, 2 mm long; lobes subulate, 10–17 × 2–3 mm, with a distinct midvein, glabrous within or with a few minute hairs. *Corolla* creamy white, tube obconical-campanulate, 75–85 mm long, distinctly 10-ribbed, lobes contorted to left in bud, spreading, broadly oblong-ovate, ± 20 mm long. *Stamens*: anthers sessile, attached to tube, ± 15 mm long. *Stigma*: style 50–60 mm long; pollen presenter narrowly ellipsoid to somewhat clavate, 25 × 4 mm, extending as far as mouth of tube, or just within mouth, not exserted. *Fruit* ellipsoid, 25 × 15 mm (dried), yellowish green, glabrous, strongly 5-ribbed, crowned with persistent calyx lobes ± 4 mm long. *Seeds* 6–8 per fruit, slightly flattened, 7–9 × 6–8 mm, pale cream-coloured, somewhat rugose. Figures 24, 25.

Distribution: confined to the southeastern corner of Tanzania and the extreme northeastern region of Mozambique. Figure 26.

This taxon was first collected by H.-J. Schlieben in January 1935 near Lake Lutamba in the Lindi District of southeastern Tanzania and initially identified at Berlin (B) as *Gardenia zanguebarica*. In 1959 Petit annotated the sheet at Kew as 'cf. Didymosalpinx'. In 1973, while preparing the account of the genus for the Rubiaceae part of *Flora of tropical East Africa*, Verdcourt recognised that this collection did not match *D. norae* (Table 4) and annotated the Kew sheet as *Didymosalpinx* sp. A. Since it was then only known from this single collection, and the Kew specimen bore only one flower, Bridson & Verdcourt (1988) treated this taxon without a specific epithet.

Habitat and ecology: the habitat of *Didymosalpinx callianthus* in Tanzania is unrecorded but in Mozambique it is only found in the deeply shaded understorey of small patches of semi-deciduous forest centred on old termitaria. These forest patches are locally abundant within a matrix of semi-deciduous woodland dominated by *Berlinia orientalis* (Caesalpiniaceae), *Uapaca nitida* var. *nitida* (Euphorbiaceae) and *Parinari curatellifolia* (Chrysobalanaceae), occurring on sandy coastal soils ± 50 km from the sea and at ± 140 m a.s.l. Rainfall experienced at the Mozambique locality is about 1 100 mm per annum, received mostly from December to May. Flowering appears to occur from late November to January.

Didymosalpinx callianthus was seen in three of these forest patches, all deeply shaded and none exceeding a metre in height. Of particular interest is the abundance of the family Rubiaceae in the understorey of these small patches of forests. Apart from the *Didymosalpinx*, the authors also collected in these forest patches *Chassalia* sp. D. (cf. *C. umbraticola*), *Chazaliella abrupta* var. *abrupta*, *Coffea schliebenii*, *Coptosperma supra-axillare*, *Cremaspora triflora* subsp. *confluens*, *Gardenia transvenulosa*, *Ixora* sp., *Leptactina delagoensis*, *Oxyanthus latifolius*, *O. biflorus*, *Psychotria* sp. cf. *capensis*, *Psydrax micans*, *Triainolepis africana* subsp. *hildebrandtii*, *Tricalysia coriacea* subsp. *nyassae* and *T. semidecidua*.

Conservation status: a range-restricted species (extent of occurrence: 2 400 km^2, area of occupancy: 300 km^2), known to occur at present at only two locations where they are both threatened by habitat loss due to rural development and, in the Mozambique location, by possible drilling of oil wells. None of the subpopulations

TABLE 4.—Comparison of characters between *Didymosalpinx norae* and *D. callianthus*

Character	*D. norae*	*D. callianthus*
Habit	Tree 3–8 m tall, sometimes scandent	Shrub or treelet 0.5–1 m tall
Spines	Usually present	Absent
Calyx lobe (mm)	3–6 × 1.0–1.5	10–17 × 2–3
Corolla tube length	37–60 mm	75–85 mm
Altitude (m)	± 700– ± 1 500	140–240

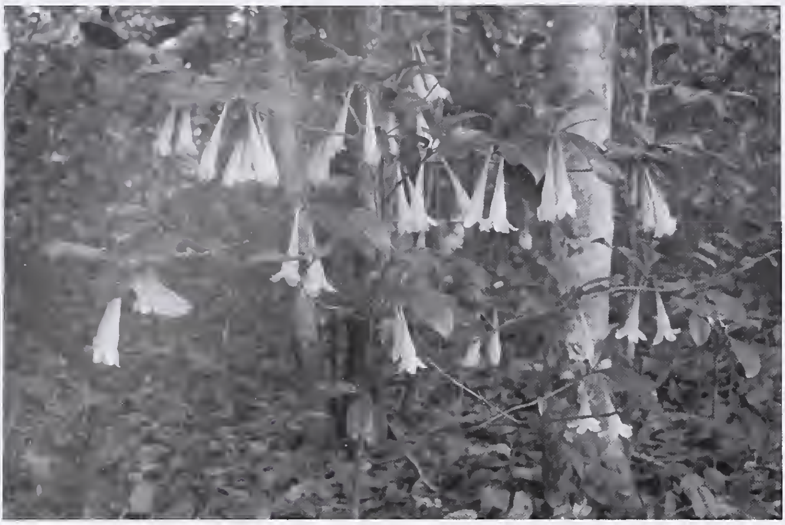


FIGURE 25.—*Didymosalpinx callianthus* in habitat, Nhica da Rovuma, Palma District, Mozambique. Photographer: John Burrows.

occur within a protected area. We therefore recommend a status of EN B1ab(iii)+2ab (iii) (IUCN 2001).

Specimens examined

TANZANIA.—1039: Lindi District, Lutamba-See (Lake Lutamba), 240 m, fl. 10 January 1935, *Schlieben 5852* (B [†?], K!).

MOZAMBIQUE.—1040: Cabo Delgado Province, Palma District, 1.9 km from turnoff to Nhica do Rovuma on Palma-Pundanhar road, 10° 50' 55"S, 40° 12' 44"E, 140 m, fl. 6 December 2008, *J.E. Burrows & S.M. Burrows 10998* (BNRH, holo.; K, LMA, P, PRE, PRU, iso.); ibid., fr. 22 March 2009, *J.E. Burrows & S.M. Burrows 11285* (BNRH, K, LMA, PRE).

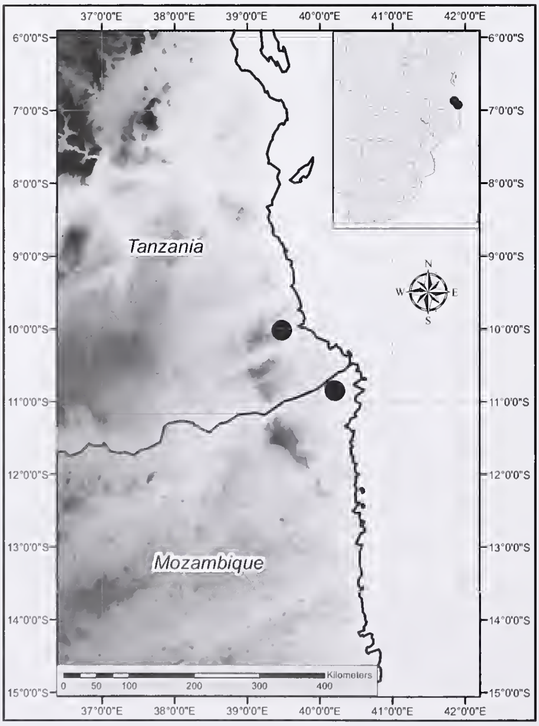


FIGURE 26.—Known distribution of *Didymosalpinx callianthus*.

Oxyanthus biflorus *J.E.Burrows & S.M.Burrows*, sp. nov., *O. zanguebarico* (Hiern) Bridson similis sed floribus solitariis vel binatis, lobis calycis parvis triangularibus 0.5 mm longis, antheris omnino inclusis, lobis corollae valde asymmetricis usque ad 40 × 11 mm, fructu anguste fusiformi 10–12 mm lato differt.

TYPE.—Mozambique, Cabo Delgado Province, Palma District, 1.9 km towards Palma from turnoff to Nhica do Rovuma on Palma-Pundanhar road, 10° 50' 55"S, 40° 12' 43"E, 140 m, 22 March 2009, *J.E. Burrows & S.M. Burrows 11286* (BNRH, holo.; K, LMA, PRE, PRU, iso.).

Evergreen shrub or treelet, 0.5–2.5 m tall, frequently suckering from base. *Bark* grey-brown, smoothish, faintly longitudinally ridged. *Branches* decussate. *Leaves* opposite, evenly spaced along branchlets, elliptic, 50–85 × 17–42 mm, apex acuminate, terminating in a fine mucro, base cuneate, slightly asymmetrical; surface shiny above, texture thinly coriaceous, domatia few, scattered, rather indistinct, set with a few sparse, stiff hairs; margin entire, flat; stipules subulate-lanceolate, 8–12 × 2.5 mm, glabrous on both surfaces. *Flowers* held ± erect from ± horizontal branchlets, borne alternately in axils at successive nodes, in pairs from short, common peduncle; peduncle subsessile, up to 2 mm long, partly obscured by stipules; inflorescence branches absent; pedicel 9–20 mm long, glabrous; bracteole borne at articulation between peduncle and pedicel, linear-subulate, 1–2 mm long, caducous. *Calyx* limb cupuliform, 2 mm long, subtruncate with 5 small short triangular teeth 0.5 mm long, glabrous. *Corolla* white, fragrant, tube straight, 100–115 × 2.0–2.5 mm, throat with scattered hairs extending 8 mm down inside tube; lobes 5, contorted to the left in bud, lanceolate asymmetric-dimidiate, up to 40 × 11 mm, spreading to reflexed. *Anthers* mostly included in throat, 5 mm long, sessile, dorsifixed almost at base, apex with a 1 mm long sterile, flattened apical point which just protrudes beyond throat at anthesis; pollen shed at time of flower opening when pollen presenter is still fully included within tube; stigma clavate, 2-lobed, eventually exserted by 3 mm. *Ovary* inferior, 7 mm long at anthesis, 2-locular, placentation axile.

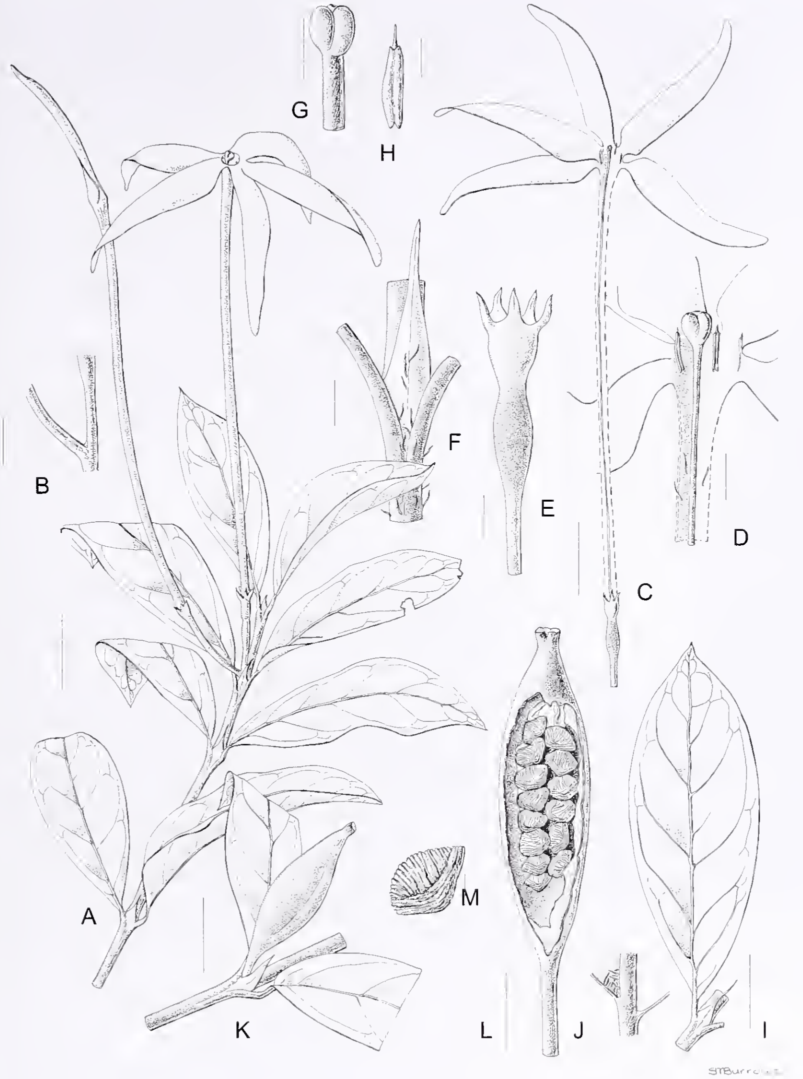


FIGURE 27.—*Oxyanthus biflorus*, *Burrows & Burrows 11286*. A, flowering branch; B, peduncle and pedicel base; C, flower with tube cut away; D, flower throat with anthers; E, calyx tube; F, stipule; G, stigma; H, anther; I, leaf; J, domatium; K, fruit; L, fruit with seed exposed; M, seed. Scale bars: A, C, I, K, 20 mm; L, 10 mm; B, D, 5 mm; E–H, 2 mm; M, 1 mm. Artist: Sandra Burrows.

Fruit narrowly ellipsoid-fusiform, 40–45 × 10–12 mm, glabrous, smooth or very faintly ribbed, yellowish green when ripe, crowned with the persistent ± truncate calyx. *Seeds* 3.0–3.5 mm diam., arranged in 4 rows of ± 8 seeds per row, brown, densely ridged, resembling a ball of string. Figure 27.

Distribution: coastal southeastern Tanzania and the Palma area of Cabo Delgado Province in Mozambique. Figure 28.

Although Clarke collected material of this taxon in bud in 1995, it was not until 2009 that a fully-opened flower of *Oxyanthus biflorus* was seen. Up until 2008 the taxon was not known to occur in Mozambique but it is not surprising that another species, previously thought to be confined to the Lindi Centre of Endemism (Clarke 2001), has now been recorded in the adjacent Cabo Delgado Province of Mozambique. *Oxyanthus biflorus* may be conspecific with *O.* sp. A. of *Flora of tropical East Africa*. *Oxyanthus biflorus* is most closely related to *O. zanguebaricus* (Table 5).

Bridson (2003: 687) states that *Oxyanthus querimbensis* Klotzsch, which she regards as an imperfectly known species, and the type of which has been destroyed in Berlin, could be conspecific with *O. zanguebaricus*. Now that *O. biflorus* has been described

TABLE 5.—Comparison of characters between *Oxyanthus zanguebaricus* and *O. biflorus*

Character	*O. zanguebaricus*	*O. biflorus*
Flowers per inflorescence	(3–)5–11	1 or 2
Calyx lobe shape and length	linear-subulate, (4–)5–8 mm	triangular, 0.5 mm
Corolla lobe (mm)	even, 10–22 × 3–5	asymmetric, up to 40 × 11
Fruit shape and width	pyriform, 24–32 mm	fusiform, 10–12 mm

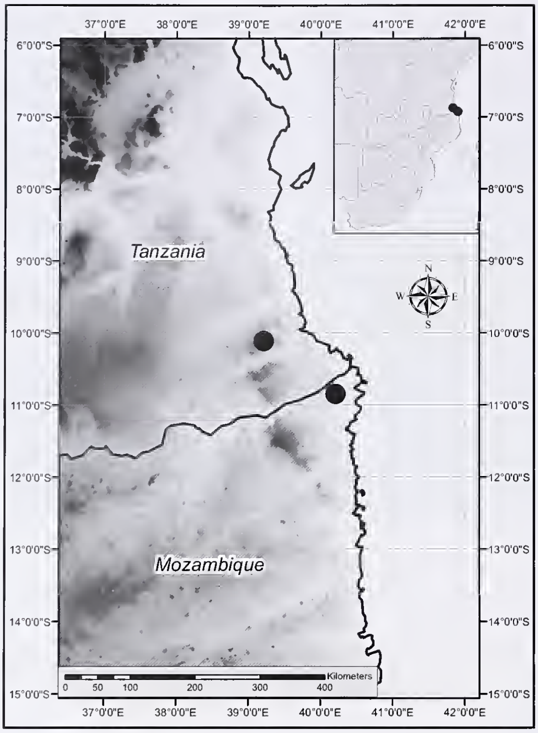


FIGURE 28.—Known distribution of *Oxyanthus biflorus*.

from the same general area of northern Mozambique, it too could be considered as the lost *O. querimbensis*. However, since *O. zanguebaricus* has been recorded from the coastal belt immediately adjacent to the Querimba Islands, and since *O. biflorus* has only been recorded from the slightly higher plateau woodlands further inland, *O. zanguebaricus* remains the most likely contender for the lost *O. querimbensis*.

Habitat and ecology: in seasonally dry, semi-evergreen forest with *Milicia excelsa*, *Dialium holtzii*, *Albizia* sp., *Pteleopsis myrtifolia*, *Uapaca nitida*, *Hymenaea verrucosa* and *Berlinia orientalis*. The plants grow in moderate to deep shade of forest and bush clumps, on sandy soils. Altitude ranges from near sea level to 850 m. Average rainfall recorded in its area of occurrence is 900–1 100 mm per annum, falling mostly from December to May. Flowering appears to take place from mid-December to the end of February.

Conservation status: a range-restricted species (extent of occurrence: 3 200 km^2, area of occupancy: 700 km^2), known to occur at present at only five locations where they are all threatened by habitat loss due to rural development and, in the Mozambique location, by possible drilling of oil wells. None of the subpopulations occur within an effectively protected area. We therefore recommend a status of EN B1ab(iii)+2ab (iii) (IUCN 2001).

Specimens examined

TANZANIA.—1039: Lindi District, Rondo Plateau, Rondo Forest Reserve, 10° 07'S, 39° 13'E, 750 m, imm. fr. 3 February 1991, *Bidgood, Abdallah & Vollesen 1341* (DSM, K!); ibid., imm. fl. 6 February 1991, *Bidgood, Abdallah & Vollesen 1364* (DSM, K!); Rondo Plateau, 10° 07'S, 39° 12'E, 850 m, imm. fr.16 June 1995, *Clarke 29* (DSM, K!).

MOZAMBIQUE.—1040: Cabo Delgado Province, Palma District, 1.9 km from turnoff to Nhica do Rovuma on Palma-Pundanhar road, 10° 50' 55"S, 40° 12' 43"E, 128 m, fl. & fr. 22 March 2009, *J.E. Burrows & S.M. Burrows 11286* (BNRH, holo.; K, LMA, PRE, PRU); ibid., 10° 50' 55"S, 40° 12' 44"E, 140 m, imm. fl. 6 December 2008, *Burrows & Burrows 11016* (BNRH, K, LMA); ibid., fl. 10 December 2008, *Müller 4125* (BNRH, K, LMA, P).

ACKNOWLEDGEMENTS

The Keeper of the Herbarium at the Royal Botanic Gardens, Kew, as well as Dr Aaron Davis, are thanked for allowing the authors to examine their material. The Instituto de Investigação Agrária de Moçambique (IIAM) granted permission to collect plants in Mozambique. The Mozambique 2008 expedition, funded by the Prince Albert II of Monaco Foundation and the Stavros Niarchos Foundation, and organized by Pro-Natura International (PNI) and the Muséum national d'Histoire naturelle (MNHN), is acknowledged for providing the opportunity to visit this area in Cabo Delgado in December 2008. Thanks to Dr Hugh Glen for the Latin translation, Lize van Staden for assisting with the IUCN conservation assessment, and Mervyn Lötter for producing the distribution maps.

REFERENCES

BRIDSON, D. 2003. Rubiaceae 3. In G.V. Pope, *Flora zambesiaca*, 5,3: 379–720.

BRIDSON, D. & VERDCOURT, B. 1988. Rubiaceae 2. In R.M. Polhill, *Flora of tropical East Africa*, Rubiaceae (2): 523–526.

CLARKE, G.P. 2001. The Lindi centre of endemism in southeastern Tanzania. *Systematics and Geography of Plants* 71: 1063–1072.

IUCN. 2001. *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

J.E. BURROWS* and S.M. BURROWS*

---

* Buffelskloof Herbarium, P.O. Box 710, 1120 Lydenburg, South Africa. E-mail: botart@mweb.co.za.
MS. received: 2010-01-25.

Bothalia 40,2: 205–218 (2010)

Checklist of ferns and seed plants of the Golden Gate Highlands National Park, South Africa

M.E. DAEMANE*, B-E. VAN WYK**† and A. MOTEETEE**

Keywords: checklist, Golden Gate, northeastern Free State, South Africa, Transfrontier Conservation Area

ABSTRACT

A list of flowering plants and ferns has been compiled for the Golden Gate Highlands National Park, which occupies an area of 11 346 hectares but excludes the adjacent QwaQwa National Park. The checklist comprises 846 taxa (823 species and 23 infraspecific taxa) representing 359 genera in 101 families. Eleven of the species are recorded in the Red Data List (Raimondo *et al*. 2010) and 64 species are naturalized exotics.

INTRODUCTION

Golden Gate Highlands National Park (GGHNP) forms part of the Transfrontier Conservation Area (TFCA) that extends from the Eastern Cape, all along the Drakensberg through KwaZulu-Natal and into the Free State Province on the South African side of the international border with Lesotho. On the Lesotho side of the border, an equal portion of land, including Sehlabathebe National Park, Ts'ehlanyane Nature Reserve and Bokong Nature Reserve, forms part of the Maluti-Drakensberg (TFCA) that covers ± 5 000 km^2 and incorporates the highest mountains in southern Africa. The extreme variability in the topography, altitude and climatic conditions within the GGHNP, results in a complex mosaic of plant communities (Kay *et al*. 1993). Several ecological studies have been undertaken (Potgieter 1982; Manfred 1990; Kay *et al*. 1993) in the area but no complete inventory of the flora has yet been published. The annotated checklist of plant species will form an important basis for future work, particularly the compilation and refinement of the Red Data List (RDL) and also vegetation mapping of the park. This information is in turn useful in the Conservation Development Framework (CDF) process undertaken by South African National Parks; that will then contribute towards effective management of the park.

STUDY AREA

Golden Gate Highlands National Park is situated in the Rooiberge of the northeastern Free State and contains the foothills of the Maluti Mountains. A locality map of the study area is shown in Figure 1. The park is ± 360 km from Johannesburg and 56 km southeast of Bethlehem, near the border between Lesotho and the Republic of South Africa. The area is situated between 28° 33'and 28° 40' E longitude, 28° 28' and 28° 37' S latitude and altitude between 1 837 and 3 099 m (Kay *et al*. 1993). The vegetation of the park is predominantly grassland, with a very small percentage of shrub forest and Afromontane forest along the rivers and in sheltered places that are protected from fire (Manfred 1990). In the recent vegetation map for southern Africa (Mucina & Rutherford 2006), four dominant vegetation units are distinguished in the Golden Gate area, namely Northern Drakensberg Highland Grassland (Gd 5), Lesotho Highland Basalt Grassland (Gd 8), Eastern Free State Sandy Grassland (Gm 4) and Basotho Montane Shrubland (Gm 5). The park is a popular tourist attraction due to the scenic beauty and spectacular rock formations.

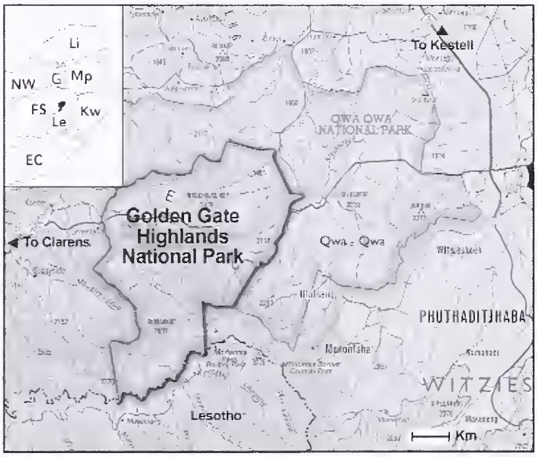


FIGURE 1.—Map of Golden Gate Highlands National Park. EC, Eastern Cape; FS, Free State; KW, KwaZulu-Natal; Le, Lesotho; Li, Limpopo; Mp, Mpumalanga; NW, North-West; G, Gauteng.

METHODS

Herbarium specimens were collected by several collectors over a period of more than 15 years. Most of the collections were made by the second author and by scientists of the South African National Parks Herbarium (KSAN). Other reference material and voucher specimens are from the records in the National Herbarium, Pretoria (PRE). Duplicates of the specimens are housed

---

* South African National Parks, Arid Ecosystems Research Unit, P.O. Box 110040, Hadison Park 8306, Kimberley, South Africa.

** Department of Botany and Plant Biotechnology, University of Johannesburg, P.O. Box 524, Auckland Park 2006, Johannesburg, South Africa.

† Corresponding author: e-mail address: bevanwyk@uj.ac.za.

MS. received: 2008-04-04.

TABLE 1.—No. families, genera and species of flowering plants and ferns recorded in Golden Gate Highlands National Park

	Families	Genera	Indigenous spp.	Naturalized exotics	RDL
Pteridophyta	9	14	24	0	0
Gymnospermae	2	2	1	1	0
Angiospermae					
Dicotyledonae	69	228	481	48	7
Monocotyledonae	21	115	253	15	4
Total	101	359	759	64	11

TABLE 2.—List of species recorded in Red List (Raimondo *et al.* 2010)

Species	Family	Broad Category	IUCN Category
Aloe greatheadii var. *davyana*	Asphodelaceae	Lower Risk	LC
Delosperma ashtonii	Mesembryanthemaceae	Lower Risk	LC
Diascia integerrima	Scrophulariaceae	Lower Risk	LC
Erica flanaganii	Ericaceae	Data Deficient	LC
Eucomis autumnalis subsp. *clavata*	Hyacinthaceae	Data Deficient	Declining
Galtonia viridiflora	Hyacinthaceae	Lower Risk	LC
Gymnopentzia bifurcata	Asteraceae	Threatened	LC
Lobelia erinus	Lobeliaceae	Lower Risk	LC
Merwilla plumbea	Hyacinthaceae	Data Deficient	NT
Protea roupelliae subsp. *roupelliae*	Proteaceae	Lower Risk	LC
Sisymbrium turczaninowii	Brassicaceae	Lower Risk	LC

LC, Least Concern; NT, Not Threatened.

in the South African National Park Herbarium (KSAN), University of Johannesburg Herbarium (JRAU), National Herbarium (PRE) and Geo-Potts Herbarium, University of the Free State (BLFU). The nomenclature and arrangement of the checklist follow Germishuizen & Meyer (2003) and Moffett (2007). Accepted genus and species names are in bold print and collectors are shown in italics. Author citations appear in the checklist and are not repeated elsewhere. Specimens in PRE and KSAN herbaria were mostly considered for listing as voucher specimens. Duplicates were excluded, so that all the numbers of the various collectors are not included. A few herbarium specimens do not have accurate information on the collectors but they were nevertheless included in the checklist for future reference. Naturalized exotic species are marked with an asterisk.

RESULTS

A total of 846 taxa (823 species and 23 infraspecific taxa) representing 359 genera in 101 families, were recorded in Golden Gate Highlands National Park (Table 1). The largest families are the Poaceae, with 55 genera and 127 species and the Asteraceae, with 49 genera and 144 species. More than half the genera and the species are dicotyledons. Eleven species fall under the Red Data List (Table 2). The high number of naturalized exotics (64 species or more than 7 % of the flora) is noteworthy. The list includes 24 species of Pteridophyta and 66 species of woody plants (trees and shrubs) of which 12 are aliens.

ACKNOWLEDGEMENTS

We wish to thank the South African National Parks for allowing us to carry out this study. Special thanks to Ms Olivia Peuker (AERU, SANParks) for assisting with the compilation and interpretation of Red Data species as well as Dr H. Bezuidenhout and Mr L. Munyai (both SANParks) for their assistance. We also wish to thank the Director and staff of the National Herbarium (PRE) for the identification of many specimens. Dr Zietsman of the National Museum Bloemfontein is acknowledged for assistance with species identification. The University of Johannesburg is acknowledged for providing financial and logistic support.

REFERENCES

GERMISHUIZEN, G. & MEYER, L.M. (eds). 2003. Plants of southern Africa: an annotated checklist. *Strelitzia* 14. National Botanical Institute, Pretoria.

KAY, C., BREDENKAMP, G.J. & THERON, G.K. 1993. The plant communities of the Golden Gate Highlands National Park in the northeastern Orange Free State. *South African Journal of Botany* 59: 442–449.

MANFRED, D.M. 1990. *The structure and floristic composition of afromontane forests in the Golden Gate Highlands National Park.* B.Sc. Honours thesis, Department of Botany, University of Johannesburg.

MOFFETT, R.O. 2007. Name changes in the Old World *Rhus* and recognition of *Searsia* (Anacardiaceae). *Bothalia* 37: 165–175.

MUCINA, L. & RUTHERFORD, M.C. (eds). 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

POTGIETER, J.W. 1982. *'n Plantekologiese studie van die Golden Gate Hoogland Nasionale Park, Clarens, Oranje Vrystaat.* M.Sc. thesis, Department of Botany, University of the Orange Free State, Bloemfontein.

RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C., KAMUNDI, D.A. & MANYAMA, P.A. (eds). 2010. Red List of South African plants 2009. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

CHECKLIST

PTERIDOPHYTES

ANEMIACEAE

- **Mohria caffrorum** (L.) Desv.; *B-E. & M. van Wyk 2323* (KSAN)

ASPLENIACEAE

- **Asplenium**
  - **adiantum-nigrum** L. var. **adiantum-nigrum**; *A.P. van der Linde 11* (PRE)
  - **aethiopicum** (Burm.f.) Bech. subsp. **aethiopicum**; *B-E. & M. van Wyk 2369a* (JRAU); *Gertenbach & Groenewald 8979* (PRE)
  - **cordatum** (Thunb.) Sw.; *B-E. & M. van Wyk 2964* (KSAN); *A.P. van der Linde 12* (PRE)
  - **monanthes** L.; *B.R. Roberts 3237* (BLFU)
  - **trichomanes** L. subsp. **quadrivalens** D.E.Mey. emend. Lovis; *B.R. Roberts 3252* (BLFU); *B-E. & M. van Wyk 2702* (JRAU)

BLECHNACEAE

- **Blechnum** L.
  - **australe** L.; *A.P. van der Linde 10* (KSAN)
  - **punctulatum** Sw. var. **punctulatum**; *B-E. & M. van Wyk 2335* (JRAU)

DRYOPTERIDACEAE

- **Polystichum monticola** N.C.Anthony & Schelpe; *Gertenbach & Groenewald 9167* (PRE)

EQUISETACEAE

- **Equisetum ramosissimum** Desf.; *B-E. & M. van Wyk 2475* (JRAU)

POLYPODIACEAE

- **Lepisorus schraderi** (Mett.) Ching; *A.P. van der Linde 16* (PRE)
- **Pleiopeltis macrocarpa** (Bory ex Willd.) Kaulf.; *B-E. & M. van Wyk 2377a* (JRAU); *L.C.C. Liebenberg 7583* (KSAN)

PTERIDACEAE

- **Adiantum** L.
  - **capillus-veneris** L.; *B-E. & M. van Wyk 2817* (KSAN); *L. & P.C. Zietsman 62* (PRE)
  - **poiretii** Wikstr.; *B-E. & M. van Wyk 2336* (JRAU); *A.P. van der Linde 9* (KSAN)
- **Cheilanthes** Sw.
  - **eckloniana** (Kunze) Mett.; *B-E. & M. van Wyk 2306* (JRAU); *L. & P.C. Zietsman 546* (PRE)
  - **hirta** Sw.; *B-E. & M. van Wyk 2892* (KSAN); *A.P. van der Linde 15* (PRE)
  - **quadripinnata** (Forssk.) Kuhn; *B-E. & M. van Wyk 2301* (JRAU); *J.C. Scheepers GG181* (PRE)
  - **viridis** (Forssk.) SW. var. **viridis**; *Daemane & Gerald 38* (KSAN)
- **Pellaea calomelanos** (Sw.) Link var. **calomelanos**; *B-E. & M. van Wyk 2322* (JRAU); *Gertenbach & Groenewald 8978* (PRE)
- **Pteris cretica** L.; *B-E. & M. van Wyk 2363a* (JRAU); *P.C. Zietsman 65* (PRE)

SELAGINELLACEAE

- **Selaginella** P.Beauv.
  - **caffrorum** (Milde) Hieron.; *J.C. Scheepers GG165* (PRE)
  - **dregei** (C.Presl) Hieron.; *B-E. & M. van Wyk 2332* (KSAN)

WOODSIACEAE

- **Cystopteris fragilis** (L.) Bernh.; *B.R. Roberts 3227* (BLFU)
- **Woodsia burgessiana** Gerr. ex Hook. & Baker; *B.R. Roberts 3259* (PRE)

GYMNOSPERMS

PINACEAE

- ***Pinus halepensis** Mill. var. **halepensis**; *Gertenbach & Groenewald 9227* (KSAN)

PODOCARPACEAE

- **Podocarpus latifolius** (Thunb.) R.Br. ex Mirb.; *B-E. & M. van Wyk 2376a* (JRAU); *L. & P.C. Zietsman 66* (PRE)

DICOTYLEDONS

ACANTHACEAE

- **Barleria monticola** Oberm.; *Gertenbach & Groenewald 9109* (PRE); *P.C. Zietsman 3505* (KSAN)
- **Chaetacanthus setiger** (Pers.) Lindl.; *P.C. Zietsman 3552* (KSAN)
- **Crabbea sp.**; *J.W. Potgieter 96* (BLFU)

ACHARIACEAE

- **Kiggelaria africana** L.; *B-E. & M. van Wyk 2696* (KSAN); *B.R. Roberts 3266* (PRE)

AMARANTHACEAE

- ***Achyranthes aspera** L. var. **aspera**; *B-E. & M. van Wyk 2834* (KSAN)
- ***Alternanthera pungens** Kunth; *Gertenbach & Groenewald 9201* (KSAN)
- **Cyathula blumeuncinulata** (Schrad.) Schinz; *M.P.K Meyer 7026* (PRE); *P.C. Zietsman 555* (PRE)

ANACARDIACEAE

- **Searsia** F.A.Barkley
  - **burchellii** (Sond. ex Engl.) Moffett; *P.C. Zietsman 3528* (PRE)
  - **dentata** (Thunb.) Moffett; *B-E. & M. van Wyk 2472* (JRAU); *B.R. Roberts 3231* (PRE)
  - **discolor** (E.Mey. ex Sond.) Moffett; *B-E. & M. van Wyk 2498* (JRAU); *Gertenbach & Groenewald 8801* (PRE)
  - **divaricata** (Eckl. & Zeyh.) Moffett; *Gertenbach & Groenewald 9130* (PRE); *B.R. Roberts 3089* (PRE)
  - **erosa** (Thunb.) Moffett; *Gertenbach & Groenewald 9217* (PRE); *Daemane & Gerald 56* (KSAN)
  - **laevigata** (L.) F.A.Barkley; *B-E. & M. van Wyk 2380a* (JRAU)
  - **pallens** (Eckl. & Zeyh.) Moffett; *Gertenbach & Groenewald 8963* (PRE)
  - **pyroides** (Burch.) Moffett var. **gracilis** (Engl.) Moffett; *B-E. & M. van Wyk 2389a* (JRAU); *Gertenbach & Groenewald 8945* (PRE)
  - **undulata** (Jacq.) T.S.Yi, A.J.Mill & J.Wen; *M.L. Jacobs 8570* (KSAN)

APIACEAE

- **Alepidea** F.Delaroche
  - **cordifolia** B.-E.Van Wyk; *A. Spies 47938* (PRE); *B.R. Roberts 3372* (PRE)
  - **peduncularis** A.Rich.; *L.C.C. Liebenberg 7503* (PRE); *B.R. Roberts 3210* (PRE)
  - **setifera** N.E.Br.; *Groenewald & Daleen 8739* (PRE); *B.R. Roberts 3377* (PRE)
- **Berula erecta** (Huds.) Coville subsp. **thunbergii** (DC.) B.L.Burtt; *Gertenbach & Groenewald 8743* (PRE); *L.C.C. Liebenberg 7542* (PRE)
- **Bupleurum mundii** Cham. & Schltdl.; *L.C.C. Liebenberg 6985* (PRE)
- **Conium chaerophylloides** (Thunb.) Sond.; *L.C.C. Liebenberg 7446* (PRE)
- **Heteromorpha arborescens** (Spreng.) Cham. & Schlechtd. var. **abyssinica** (A.Rich.) H.Wolff; *B-E. & M. van Wyk 2388a* (JRAU); *Gertenbach & Groenewald 8957* (KSAN)
- ***Pastinaca sativa** L.; *L.C.C. Liebenberg 7010* (PRE)
- **Peucedanum caffrum** (Meisn.) E.Phillips; *B.R. Roberts 3356* (PRE)
- **Polemannia** Eckl. & Zeyh.
  - **montana** Schltr. & H.Wolff; *J.W. Potgieter 283* (BLFU)
  - **simplicior** Hilliard & B.L.Burtt; *R.O. Moffett & I. Crouch 4474* (PRE)

APOCYNACEAE

- **Asclepias** L.
  - **humilis** (E.Mey.) Schltr.; *B.R. Roberts 3422* (PRE)
  - **sp.** *B.R. Roberts 3189* (PRE)

Asclepias L. (cont.)
stellifera Schltr.; *P.C. Zietsman 2823* (PRE); *L.C.C. Liebenberg 7269* (PRE)
Aspidoglossum E.Mey.
interruptum (E.Mey.) Bullock; *L.C.C. Liebenberg 6912* (PRE)
lamellatum (Schltr.) Kupicha; *Gertenbach & Groenewald 8859* (PRE)
Gomphocarpus R.Br.
fruticosus (L.) Aiton f.
subsp. **decipiens** (N.E.Br.) Goyder & Nicholas; *J.W. Potgieter 386* (BLFU)
subsp. **fruticosus**; *Gertenbach & Groenewald 9117* (KSNA); *L.C.C. Liebenberg 6842* (PRE)
tomentosus Burch. subsp. **tomentosus**; *J.W. Potgieter 387* (BLFU)
Miraglossum pulchellum (Schltr.) Kupicha; *Gertenbach & Groenewald 8905* (PRE)
Raphionacme hirsuta (E.Mey.) R.A.Dyer ex E.Phillips; *B-E. & M. van Wyk 2387* (JRAU); *P.C. Zietsman 3569* (PRE)
Riocreuxia torulosa Decne.; *L.C.C. Liebenberg 6830* (PRE); *P.C. Zietsman 2979* (PRE)
Schizoglossum E.Mey.
atropurpureum E.Mey. subsp. **atropurpureum**; *L.C.C. Liebenberg 7554* (PRE)
bidens E.Mey.
subsp. **bidens**; *L.C.C. Liebenberg 6946* (PRE)
subsp. **pachyglossum** (Schltr.) Kupicha; *L.C.C. Liebenberg 6995* (PRE)
nitidum Schltr.; *B.R. Roberts 3150* (BLFU)
stenoglossum Schltr. subsp. **latifolium** Kupicha; *B.R. Roberts 3085* (PRE)
Xysmalobium R.Br.
parviflorum Harv. ex Scott-Elliot; *L.C.C. Liebenberg 7268* (PRE); *J.J. Blom 73* (PRE)
undulatum (L.) Aiton f. var. **undulatum**; *J.W. Potgieter 343* (BLFU)

AQUIFOLIACEAE

Ilex mitis (L.) Radlk. var. **mitis**; *B-E. & M. van Wyk 2382a* (JRAU); *P.C. Zietsman* 2965 (PRE)

ARALIACEAE

Cussonia paniculata Eckl. & Zeyh. subsp. **sinuata** (Reyneke & Kok) De Winter; *B-E. & M. van Wyk 2382a* (JRAU); *B.R. Roberts 3405* (PRE)

ASTERACEAE

Arctotis L.
arctotoides (L.f.) O.Hoffm.; *B-E. & M. van Wyk 2690* (JRAU)
microcephala (DC.) Beauverd; *B.R. Roberts 3132* (PRE)
venusta Norl.; *H. Bezuidenhout 739* (KSAN)
Artemisia afra Jacq. ex Willd.; *B.R. Roberts 3312* (PRE); *L. & P.C. Zietsman 559* (PRE)
Aster L.
bakerianus Burtt Davy ex C.A.Sm.; *B-E. & M. van Wyk 2715* (JRAU); *Gertenbach & Groenewald 8847* (KSAN)
lydenburgensis W.Lippert; *J.W. Potgieter 549* (BLFU)
perfoliatus Oliv.; *B-E. & M. van Wyk 2720* (KSAN); *B.R. Roberts 3381* (PRE)
pleiocephalus (Harv.) Hutch.; *Gertenbach & Groenewald 8932* (KSAN); *P.C. Zietsman 3272* (PRE)
Athrixia Ker Gawl.
angustissima DC.; *L.C.C. Liebenberg 6863* (PRE); *B.R. Roberts 3207* (PRE)
elata Sond.; *B-E. & M. van Wyk 2325* (JRAU); *P.C. Zietsman 3531* (PRE)
Berkheya Ehrh.
cirsiifolia (DC.) Roessler; *R. Story 1969* (PRE); *L.C.C. Liebenberg 6971* (PRE)
discolor (DC.) O.Hoffm. & Muschl.; *B-E. & M. van Wyk 2640* (KSAN)
montana J.M.Wood & M.S.Evans; *Daemane & Gerald 26* (KSAN)
onopordifolia (DC.) O.Hoffm. ex Burtt Davy var. **onopordifolia**; *L. Henderson 785* (PRE)
pinnatifida (Thunb.) Thell. subsp. **stobaeoides** (Harv.) Roessler; *Gertenbach & Groenewald 9189* (KSAN)
purpurea (DC.) Mast.; *B.R. Roberts 3203* (PRE)
rhapontica (DC.) Hutch. & Burtt Davy subsp. **aristosa** (DC.) Roessler var. **aristosa**; *L.C.C. Liebenberg 6869* (PRE)
rosulata Roessler; *L.C.C. Liebenberg 6949* (PRE); *B.R. Roberts 3112* (PRE)
speciosa (DC.) O.Hoffm.
subsp. **lanceolata** Roessler; *L.C.C. Liebenberg 6973* (PRE); *B.R. Roberts 3243* (PRE)
subsp. **speciosa**; *Gertenbach & Groenewald 8934* (KSAN); *L.C.C. Liebenberg 7013* (PRE)
Chrysanthemoides monilefera (L.) Norl. subsp. **canescens** (DC.) Norl.; *B-E. & M. van Wyk 2342* (JRAU); *Gertenbach & Groenewald 9166* (KSAN)
Chrysocoma ciliata L.; *B-E. & M. van Wyk 2302* (JRAU); *B.R. Roberts* 3426 (PRE)
Cineraria L.
aspera Thunb.; *Gertenbach & Groenewald 8928* (KSAN); *L.C.C. Liebenberg 7301* (PRE)
lobata L'Hér.; *B.R. Roberts 3370* (PRE)
lyratiformis Cron; *D.G. Steyn 30* (PRE); *E. van der Berg 9946* (PRE)
***Cirsium vulgare** (Savi) Ten.; *L.C.C. Liebenberg 7533* (PRE); *B.R. Roberts 3437* (PRE)
Conyza Less.
***albida** Spreng; *J.W. Potgieter 407* (BLFU)
pinnata (L.f.) Kuntze; *J.W. Potgieter 21* (BLFU)
podocephala DC.; *L.C.C. Liebenberg 7423a* (PRE); *M.P.K. Meyer 6974* (PRE)
Cotula L.
hispida (DC.) Harv.; *L.C.C Liebenberg 7032* (PRE); *B.R. Roberts 3369* (PRE)
microglossa (DC.) O.Hoffm. & Kuntze ex Kuntze; *J.W. Potgieter 61* (BLFU)
***Crepis hypochaeridea** (DC.) Thell.; *B-E. & M. van Wyk 2539* (JRAU); *L.C.C. Liebenberg 7334* (PRE)
Denekia capensis Thunb.; *Gertenbach & Groenewald 9116* (KSAN); *P.C. Zietsman 3549* (PRE)
Dicoma anomala Sond. subsp. **anomala**; *B-E. & M. van Wyk 2858* (KSAN); *L. & P.C. Zietsman 548* (PRE)
Dimorphotheca Vaill. ex Moench
caulescens (Harv.) Harv.; *J.W. Potgieter 193* (BLFU)
jucunda E.Phillips; *P.C. Zietsman 3572* (KSAN); *A.M. Jacot Guillarmod 2130* (PRE)
Euryops (Cass.) Cass.
laxus (Harv.) Burtt Davy; *B.R. Roberts 3190* (BLFU)
pedunculatus N.E.Br.; *L.C.C. Liebenberg 6938* (PRE)
transvaalensis Klatt subsp. **setilobus** (N.E.Br.) B.Nord.; *P.C. Zietsman 3518* (KSAN); *L.C.C. Liebenberg 8233* (PRE)
Felicia Cass.
fascicularis DC.; *L.C.C. Liebenberg 7019* (PRE)
filifolia (Vent.) Burtt Davy subsp. **filifolia**; *B-E. & M. van Wyk 2315a* (JRAU); *Gertenbach & Groenewald 8950* (KSAN)
muricata (Thunb.) Nees subsp. **muricata**; *Gertenbach & Groenewald 8940* (KSAN); *B.R. Roberts 3141* (PRE)
petiolata (Harv.) N.E.Br.; *B.R. Roberts 3286* (PRE)
rosulata Yeo; *L.C.C. Liebenberg 8223* (PRE)
Gazania Gaertn.
krebsiana Less.
subsp. **krebsiana**; *B-E. & M. van Wyk 2368* (JRAU); *B.R. Roberts 3440* (PRE)
subsp. **serrulata** (DC.) Roessler; *Gertenbach & Groenewald 9123* (KSAN); *P.C. Zietsman 2690* (PRE)
Gerbera L.
ambigua (Cass.) Sch.Bip.; *B-E. & M. van Wyk 2372* (JRAU); *L.C.C. Liebenberg 7285* (PRE)
piloselloides (L.) Cass.; *B-E. & M. van Wyk 2367* (KSAN)
viridifolia (DC.) Sch.Bip.; *S. Barendse 12* (KSAN)
Gymnopentzia bifurcata Benth.; *J.W. Potgieter 18* (BLFU)
Haplocarpha scaposa Harv.; *B-E. & M. van Wyk 2705* (PRE); *B.R. Roberts 6917* (PRE)
Helichrysum Mill.
adenocarpum DC. subsp. **adenocarpum**; *B-E. & M. van Wyk 2731* (JRAU); *B.R. Roberts 3272* (PRE)
appendiculatum (L.f.) Less.; *Gertenbach & Groenewald 9195* (KSAN); *B.R. Roberts 3170* (PRE)
aureonitens Sch.Bip.; *B-E. & M. van Wyk 2566* (JRAU); *R.O. Moffett 5080* (PRE)
aureum (Houtt.) Merr. var. **monocephalum** (DC.) Hilliard; *B-E. & M. van Wyk 2409* (JRAU); *B.R. Roberts 3344* (PRE)
bellum Hilliard; *B-E. & M. van Wyk 2731* (KSAN)
caespititium (DC.) Harv.; *B-E. & M. van Wyk 2310* (KSAN); *L.C.C. Liebenberg 8226* (PRE)
callicomum Harv.; *J.J. Blom 24* (PRE); *P.C. Zietsman 510* (PRE)
cephaloideum DC.; *B-E. & M. van Wyk 2756* (KSAN); *P.C. Zietsman 511* (PRE)

- **Helichrysum** Mill. (cont.)
  - **cerastioides** DC. var. **cerastioides**; *A.P. Goossens 1299* (PRE)
  - **chionosphaerum** DC.; *B-E. & M. van Wyk 2503* (JRAU); *H. Bezuidenhout 748* (PRE)
  - **cooperi** Harv.; *Groenewald 8753* (KSAN); *B.R. Roberts 3371* (PRE)
  - **cymosum** (L.) D.Don subsp. **calvum** Hilliard; *L.C.C. Liebenberg 7023* (PRE)
  - **dasycephalum** O.Hoffm.; *B.R. Roberts 3092* (PRE)
  - **dregeanum** Sond. & Harv.; *B.R. Roberts 3117* (PRE)
  - **ecklonis** Sond.; *B.R. Roberts 3293* (PRE); *L.C.C. Liebenberg 7280* (PRE)
  - **herbaceum** (Andrews) Sweet; *Gertenbach & Groenewald 9176* (KSAN); *B.R. Roberts 3406* (PRE)
  - **hypoleucum** Harv.; *B-E. & M. van Wyk 2893* (JRAU); *B.R. Roberts 3291* (PRE)
  - **infaustum** J.M.Wood & M.S.Evans; *L. & P.C. Zietsman 482* (PRE)
  - **melanacme** DC.; *B-E. & M. van Wyk 2815* (KSAN); *R.O. Moffett 5121* (PRE)
  - **miconiifolium** DC.; *B-E. & M. van Wyk 2724, 2728* (JRAU); *Gertenbach & Groenewald 8834* (PRE)
  - **mundtii** Harv.; *J.C. Scheepers 1859* (PRE)
  - **nudifolium** (L.) Less.
    - var. **nudifolium**; *L.C.C. Liebenberg 6801* (PRE)
    - var. **pilosellum** (L.f.) Beentjie; *R.O. Moffett 5123* (PRE); *B-E. & M. van Wyk 2380* (KSAN); *L.C.C. Liebenberg 7318* (PRE)
  - **odoratissimum** (L.) Sweet; *J.C. Scheepers 1818* (PRE); *M.P.K. Meyer 7047* (PRE)
  - **oreophilum** Klatt; *L.C.C. Liebenberg 7001* (PRE); *D.B. Muller 1287* (PRE)
  - **pallidum** DC.; *J.J. Blom 70* (PRE)
  - **platypterum** DC.; *J.W. Potgieter 347* (BLFU)
  - **psilolepis** Harv.; *L.C.C. Liebenberg 6895* (PRE)
  - **qathlambanum** Hilliard; *R.A.Lubke 246* (PRE)
  - **rugulosum** Less.; *B-E. & M. van Wyk 2763* (JRAU); *Gertenbach & Groenewald 8936* (PRE)
  - **setosum** Harv.; *J.W. Potgieter 446* (BLFU); *B.R. Roberts 3305* (BLFU)
  - **spiralepis** Hilliard & B.L.Burtt; *Gertenbach & Groenewald 9115* (PRE); *B.R. Roberts 3105* (PRE)
  - **splendidum** (Thunb.) Less.; *B.R. Roberts 3355* (BLFU)
  - **subglomeratum** Less.; *Daemane & Gerald 47* (KSAN); *P.C. Zietsman 484* (PRE)
  - **sutherlandii** Harv.; *J.H. Toucher 5* (KSAN); *B.R. Roberts 3358* (PRE)
- **Heteromma decurrens** (DC.) O.Hoffm.; *L.C.C. Liebenberg 6874* (PRE); *A.M. Jacot Guillarmod 2124* (PRE)
- **Hirpicium armerioides** (DC.) Roessler; *L.C.C. Liebenberg 8236* (PRE)
- ***Hypochaeris radicata** L.; *B-E. & M. van Wyk 2522* (JRAU); *P.C. Zietsman 2541* (PRE)
- **Inulanthera calva** (Hutch) Källersjö; *Gertenbach & Groenewald 8907* (KSAN); *Daemane & Gerald 05* (KSAN)
- **Lactuca inermis** Forssk.; *B-E. & M. van Wyk 2359* (JRAU)
- **Metalasia densa** (Lam.) P.O.Karis; *B-E. & M. van Wyk 2317* (JRAU); *P.C. Zietsman 45* (PRE)
- **Nidorella** Cass.
  - **auriculata** DC.; *L.C.C. Liebenberg 6867* (PRE)
  - **resedifolia** DC. subsp. **resedifolia**; *B.R. Roberts 3134* (PRE)
- **Nolletia ciliaris** (DC.) Steetz; *B.R. Roberts 3201* (BLFU)
- **Othonna natalensis** Sch.Bip.; *L.C.C. Liebenberg 7333* (PRE)
- **Phymaspermum acerosum** (DC.) Källersjö; *J.H. Toucher 36* (KSAN); *P.C. Zietsman 3349* (PRE)
- **Printzia** Cass.
  - **auriculata** Harv.; *Daemane & Gerald 33* (KSAN)
  - **pyrifolia** Less.; *Gertenbach & Groenewald 9204* (KSAN)
- **Pseudognophalium** Kirp.
  - **luteo-album** (L.) Hilliard & B.L.Burtt; *J.W. Potgieter 102* (BLFU); *B.R. Roberts 3339* (BLFU)
  - **oligandrum** (DC.) Hilliard & B.L.Burtt; *J.W. Potgieter 439* (BLFU)
  - **undulatum** (L.) Hilliard & B.L.Burtt; *J.W. Potgieter 52* (BLFU); *B.R. Roberts 3354* (BLFU)
- **Relhania** L'Hér. emend. K.Bremer
  - **acerosa** (DC.) K.Bremer; *B-E. & M. van Wyk 2308* (KSAN); *B.R. Roberts 3404* (PRE)
  - **fruticosa** (L.) K.Bremer; *B.R. Roberts 3380* (PRE)
- **Schistostephium crataegifolium** (DC.) Fenzl ex Harv.; *B.R. Roberts 3187* (PRE); *P.C. Zietsman 566* (PRE)
- ***Schkuhria pinnata** (Lam.) Cabrera; *J.W. Potgieter 91* (BLFU)
- **Senecio** L.
  - **affinis** DC.; *L.C.C. Liebenberg 7043* (PRE)
  - **arabidifolius** O.Hoffm.; *B.R. Roberts 3276* (BLFU)
  - **asperulus** DC.; *L. & P.C. Zietsman 477* (PRE)
  - **burchellii** DC.; *B.R. Roberts 3327* (PRE); *L.C.C. Liebenberg 6833* (PRE)
  - **coronatus** (Thunb.) Harv.; *L.C.C. Liebenberg 7276* (PRE)
  - **erubescens** Aiton var. **crepidifolius** DC.; *B-E. & M. van Wyk 2641* (KSAN); *Gertenbach & Groenewald 8832* (PRE); *B.R. Roberts 3449* (PRE); *L.C.C. Liebenberg 7041* (PRE)
  - **glaberrimus** DC.; *B-E. & M. van Wyk 2644* (JRAU); *Gertenbach & Groenewald 8850* (KSAN)
  - **harveianus** MacOwan; *B.R. Roberts 3082* (PRE); *J. Toucher 41* (PRE)
  - **hastatus** L.; *L.C.C. Liebenberg 7024* (PRE)
  - **hieracioides** DC.; *B-E. & M. van 2948* (PRE); *B.R. Roberts 3244* (PRE)
  - **hypochoerideus** DC.; *J.W. Potgieter 74* (BLFU)
  - **inaequidens** DC.; *B-E. & M. van Wyk 2542* (JRAU); *L.C.C. Liebenberg 7511* (PRE)
  - **inornatus** DC.; *L.C.C. Liebenberg 7437* (PRE); *E. van der Berg GG7* (PRE)
  - **isatideus** DC.; *B-E. & M. van Wyk 2636* (KSAN); *Gertenbach & Groenewald 9199* (PRE)
  - **lydenburgensis** Hutch. & Burtt Davy; *B-E. & M. van Wyk 2629* (JRAU); *Gertenbach & Groenewald 8848* (KSAN)
  - **mooreanus** Hutch. & Burtt Davy; *P.C. Zietsman 495* (PRE)
  - **othonniflorus** DC.; *B.R. Roberts 3070* (PRE); *L.C.C. Liebenberg 7517* (PRE)
  - **purpureus** L.; *B.R. Roberts 5419* (NMB)
  - **rhomboideus** Harv.; *J.W. Potgieter 264* (BLFU)
  - **rhyncholaenus** DC.; *J.W. Potgieter 486* (BLFU)
  - **ruwenzoriensis** S.Moore; *J.W. Potgieter 185* (BLFU)
  - **serratuloides** DC.; *J.W. Potgieter 349* (BLFU)
  - **speciosus** Willd.; *B.R. Roberts 3443* (BLFU)
  - **subcoriaceus** Schltr.; *L.C.C. Liebenberg 7316* (PRE)
  - **subrubriflorus** O.Hoffm.; *B.R. Roberts 3276* (PRE); *L.C.C. Liebenberg 7411* (PRE)
- **Seriphium plumosum** L.; *B.R. Roberts 3031* (PRE)
- **Sonchus** L.
  - ***asper** (L.) Hill subsp. **asper**; *J.W. Potgieter 553* (BLFU)
  - **nanus** Sond. ex Harv.; *J.W. Potgieter 497* (BLFU)
- ***Tagetes minuta** L.; *J.W. Potgieter 504* (BLFU)
- ***Taraxacum officinale** Weber; *B.R. Roberts 3367* (PRE)
- **Tolpis capensis** (L.) Sch.Bip.; *Gertenbach & Groenewald 8933* (KSAN); *L.C.C. Liebenberg 6898* (PRE)
- **Trichogyne decumbens** (Thunb.) Less.; *L.C.C. Liebenberg 3337* (PRE)
- **Tripteris aghillana** DC. var. **aghillana**; *J.W. Potgieter 471*(BLFU)
- **Troglophyton capillaceum** (Thunb.) Hilliard & B.L.Burtt subsp. **diffusum** (DC.) Hilliard; *Gertenbach & Groenewald 9197* (PRE)
- **Ursinia** Gaertn.
  - **alpina** N.E.Br.; *B.R. Roberts 3386* (PRE); *L.C.C. Liebenberg 7028* (PRE)
  - **montana** DC. subsp. **montana**; *L.C.C. Liebenberg 7448* (PRE); *P.C. Zietsman 487* (PRE)
  - **nana** DC. subsp. **nana**; *B.R. Roberts 3195* (PRE); *P.C. Zietsman 34* (PRE)
- **Vernonia** Schreb.
  - **flanaganii** (E.Phillips) Hilliard; *Gertenbach & Groenewald 8939* (PRE)
  - **hirsuta** (DC.) Sch.Bip. ex Walp.; *B-E. & M. van Wyk 2531* (JRAU); *B.R. Roberts 3384* (PRE)
  - **natalensis** Oliv. & Hiern.; *B-E. & M. van Wyk 2576, 2608* (JRAU); *Gertenbach & Groenewald 8830* (PRE)
- ***Zinnia peruviana** (L.) L.; *Gertenbach & Groenewald 8740* (PRE)

BORAGINACEAE

- **Cynoglossum** L.
  - **hispidum** Thunb.; *Gertenbach & Groenewald 8929* (PRE)
  - **lanceolatum** Forssk.; *L.C.C. Liebenberg 6831* (PRE)
- ***Echium vulgare** L.; *Gertenbach & Groenewald 9188* (PRE)
- **Lithospermum** L.
  - **cinereum** A.DC.; *E.A. Ueckermann 6997* (PRE)
  - **hirsutum** E.Mey. ex A.DC.; *Gertenbach & Groenewald 8923* (PRE)
- **Myosotis** L.
  - **afropalustris** C.H.Wright ; *L. & P.C. Zietsman 491* (PRE)
  - ***sylvatica** Hoffm.; *Gertenbach & Groenewald 8897* (PRE); *B.R. Roberts 3232* (PRE)

BRASSICACEAE

- ***Capsella bursa-pastoris** (L.) Medik.; *B-E. & M. van Wyk 2600* (JRAU)

Erucastrum strigosum (Thunb.) O.E.Schulz; *Gertenbach & Groenewald 9108* (PRE)
Heliophila L.
carnosa (Thunb.) Steud.; *L.C.C. Liebenberg 6924* (PRE); *J.H. Toucher 7* (KSAN)
minima (Stephens) Marais; *P.C. Zietsman 3474* (KSAN)
rigidiuscula Sond.; *Gertenbach & Groenewald 8853* (PRE)
suavissima Burch. ex DC.; *T. Saaiman 875* (PRE)
Lepidium schinzii Thell.; *B.R. Roberts 3324* (PRE)
Sisymbrium turczaninowii Sond.; *L.C.C. Liebenberg 7468* (PRE); *P.C. Zietsman 7468* (PRE)

BUDDLEJACEAE

Buddleja L.
loricata Leeuwenb.; *B.R. Roberts 3242* (PRE); *L.C.C. Liebenberg 7294* (PRE)
salviifolia (L.) Lam.; *B-E. & M. van Wyk 2327* (JRAU); *Gertenbach & Groenewald 8942* (PRE)
Gomphostigma virgatum (L.f.) Baill.; *L.C.C. Liebenberg* 7436 (PRE); *J.J. Meyer 3173* (PRE)

CAMPANULACEAE

Craterocapsa Hilliard & B.L.Burtt
montana (A.DC.) Hilliard & B.L.Burtt; *P.C. Zietsman 3503* (PRE); *J.M. Anderson 1063* (PRE)
tarsodes Hilliard & B.L.Burtt; *Gertenbach & Groenewald 9016* (KSAN)
Wahlenbergia Schrad. ex Roth
dicterlenii (E.Phillips) Lammers; *P.C. Zietsman 3029* (PRE)
krebsii Cham. subsp. **krebsii**; *Gertenbach & Groenewald 9112* (KSAN); *B.R. Roberts 3213* (PRE)
undulata (L.f.) A.DC.; *M.L. Jacobs 8559* (PRE); *B.R. Roberts 3323* (PRE)
virgata Engl.; *S. Barendse 36* (PRE); *P.C. Zietsman 68* (PRE)

CARYOPHYLLACEAE

Cerastium arabidis E.Mey. ex Fenzl; *B-E. & M. van Wyk 2628* (JRAU); *L.C.C. Liebenberg 6923* (PRE)
Dianthus
basuticus Burtt Davy subsp. **basuticus** var. **basuticus**; *B-E. & M. van Wyk 2512* (JRAU); *L.C.C. Liebenberg 6841* (PRE)
micropetalus Ser.; *D.C.H. Plowes 7065* (PRE)
Silene L.
pilosellifolia Cham. & Schltdl.; *B-E. & M. van Wyk 2529* (KSAN); *Gertenbach & Groenewald 8711* (KSAN); *Gertenbach & Groenewald 8868* (KSAN)
undulata Aiton; *B.R. Roberts 3288* (PRE)

CELASTRACEAE

Gymnosporia (Wight & Arn.) Hook.f.
buxifolia (L.) Szyszyl.; *P.C. Zietsman 69* (PRE); *B-E. & M. van Wyk 2385a* (JRAU)
heterophylla (Eckl. & Zeyh.) Loes.; *B-E. & M. van Wyk 2385a* (JRAU); *Gertenbach & Groenewald 8965* (KSAN)
Maytenus Molina
acuminata (L.f.) Loes. var. **acuminata**; *B-E. & M. van Wyk 2373a* (JRAU); *Gertenbach & Groenewald 8959* (KSAN)
peduncularis (Sond.) Loes.; *B-E. & M. van Wyk 2874* (KSAN); *P.C. Zietsman 2989* (PRE)
undata (Thunb.) Blakelock; *B-E. & M. van Wyk 2383a* (JRAU); *Gertenbach & Groenewald 8976* (PRE)

CHENOPODIACEAE

Chenopodium L.
***album** L.; *L.C.C. Liebenberg 7474* (PRE); *P.C. Zietsman 3250* (PRE)
***giganteum** D.Don; *Gertenbach & Groenewald 9218* (PRE)

CONVOLVULACEAE

Convolvulus L.
natalensis Bernh. ex Krauss; *P.C. Zietsman 3241* (PRE)
sagittatus Thunb.; *M.P.K.Meyer 7044* (PRE)
thunbergii Roem. & Schult.; *L.C.C. Liebenberg 7306* (PRE)
Ipomoea L.
crassipes Hook.; *D.C.H. Plowes 7058* (PRE)
oblongata E.Mey. ex Choisy; *B.R. Roberts 3216* (PRE); *L.C.C. Liebenberg 6786* (PRE)
pellita Hallier f.; *Gertenbach & Groenewald 9154* (PRE)

CRASSULACEAE

Cotyledon orbiculata L. var. **orbiculata**; *B-E. & M. van Wyk 2451* (JRAU)
Crassula L.
alba Forssk. var. **alba**; *B-E. & M. van Wyk 2960* (PRE)
capitella Thunb. subsp. **thyrsiflora** (Thunb.) Toelken; *B-E. & M. van Wyk 2806* (KSAN)
compacta Schönland; *B-E. & M. van Wyk 2499* (JRAU); *Gertenbach & Groenewald 8986* (PRE)
dependens Bolus; *R. Story 1950* (PRE); *L. & P.C. Zietsman 540* (PRE)
lanceolata (Eckl. & Zeyh.) Endl. ex Walp. subsp. **lanceolata**; *L.C.C. Liebenberg 7531* (PRE); *B.R. Roberts 3202* (PRE)
sarcocaulis Eckl. & Zeyh. subsp. **rupicola** Toelken; *Gertenbach & Groenewald 8985* (PRE); *B.R. Roberts 3341* (PRE)
setulosa Harv. var. **setulosa**; *Gertenbach & Groenewald 8736* (KSAN); *H. Bezuidenhout HB711* (PRE)
vaginata Eckl. & Zeyh. subsp. **vaginata**; *B-E. & M. van Wyk 2866* (KSAN); *Groenewald 8714* (PRE)

CUCURBITACEAE

Coccinia hirtella Cogn.; *Gertenbach & Groenewald 8913* (KSAN); *B.R. Roberts 3315* (PRE)
Kedrostis foetidisima (Jacq.) Cogn.; *J.W. Potgieter 312* (BLFU)
Zehneria scabra (L.f.) Sond. subsp. **scabra**; *L.C.C. Liebenberg 7573* (PRE)

DIPSACACEAE

Scabiosa columbaria L.; *Gertenbach & Groenewald 8909* (KSAN); *B.R. Roberts 3027* (PRE)

EBENACEAE

Diospyros L.
austro-africana De Winter
var. **austro-africana**; *Gertenbach & Groenewald 8992* (KSAN)
var. **rubriflora** (De Winter) De Winter; *B-E. & M. van Wyk 2314, 2349a* (JRAU); *B.R. Roberts 3456* (PRE)
whyteana (Hiern) F.White; *Gertenbach & Groenewald 8962* (PRE); *B.R. Roberts 3398* (PRE)
Euclea Murray
coriacea A.DC.; *B-E. & M. van Wyk 2312* (JRAU); *L.C.C. Liebenberg 7547* (PRE)
crispa (Thunb.) Guerke subsp. **crispa**; *Gertenbach & Groenewald 8967* (KSAN); *P.C. Zietsman 3293* (PRE)

ERICACEAE

Erica L.
algida Bolus; *Gertenbach & Groenewald 9105* (PRE); *D.J.B. Killick 4535* (PRE)
alopecurus Harv. var. **alopecurus**; *Gertenbach & Groenewald 9029* (KSAN); *L.C.C. Liebenberg 8234* (PRE)
cerinthoides L. var. **cerinthoides**; *Gertenbach & Groenewald 9210* (KSAN), *A. Spies 43* (PRE)
drakensbergensis Guthrie & Bolus; *Daemane & Gerald 1* (KSAN)
flanaganii Bolus; *L.C.C. Liebenberg 7300* (PRE)
leucopelta Tausch var. **leucopelta**; *Gertenbach & Groenewald 9003* (PRE); *A. van der Zeyde 106* (PRE)
maesta Bolus var. **maesta**; *Gertenbach & Groenewald 9226* (PRE); *P.C. Zietsman 50* (PRE)
woodii Bolus var. **woodii**; *B.R. Roberts 3083*, *3308* (PRE)

EUPHORBIACEAE

Acalypha punctata Meisn. var. **punctata**; *Gertenbach & Groenewald 8902* (KSAN)
Clutia L.
dregeana Scheele; *P.C. Zietsman 2986* (PRE)
hirsuta (Sond.) Müll.Arg. var. **hirsuta**; *P.C. Zietsman 2842* (PRE)
natalensis Bernh.; *B-E. & M. van Wyk 2438* (KSAN); *L.C.C. Liebenberg 6845* (PRE)
pulchella L.
var. **obtusata** Sond.; *Gertenbach & Groenewald 8960* (KSAN)
var. **pulchella**; *B-E. & M. van Wyk 2378a* (JRAU); *Gertenbach & Groenewald 8944* (PRE)
Euphorbia L.
clavarioides Boiss. var. **clavarioides**; *B-E. & M. van Wyk 2304* (JRAU); *Gertenbach & Groenewald 8995* (PRE)

Euphorbia L. (cont.)
epicyparissias E.Mey. ex Boiss.; *Daemane & Gerald 22* (KSAN)
striata Thunb. var. **striata**; *B-E. & M. van Wyk 2357* (JRAU); *Gertenbach & Groenewald 8836* (KSAN)

FABACEAE

Acacia Mill.
*__dealbata__ Link.; *Gertenbach & Groenewald 9222* (KSAN)
*__decurrens__ (J.C.Wendl.) Willd.; *H. Bezuidenhout HB819* (PRE)
*__mearnsii__ De Wild.; *P.C. Zietsman 2519* (PRE)
Argyrolobium Eckl. & Zeyh.
harveyanum Oliv.; *P.C. Zietsman 2561* (PRE)
nigrescens Duemmer; *G. Germishuizen 690* (PRE)
tuberosum Eckl. & Zeyh.; *B-E. & M. van Wyk 2726* (KSAN); *L.C.C. Liebenberg 7529* (PRE)
Calpurnia E.Mey.
intrusa (R.Br. in W.T.Aiton.) E.Mey.; *B-E. & M. van Wyk 2527a* (JRAU); *Gertenbach & Groenewald 8954* (KSAN)
sericea Harv.; *L.C.C. Liebenberg 7553* (PRE); *J.C. Scheepers 1826* (PRE)
Dichilus DC.
lebeckioides DC.; *I. von Teichman 472* (PRE)
strictus E.Mey.; *B-E. & M. van Wyk 2559* (JRAU); *L.C.C. Liebenberg 7471a* (PRE)
Dolichos angustifolius Eckl. & Zeyh.; *P.C. Zietsman 3555* (PRE)
Elephantorrhiza elephantina (Burch.) Skeels; *B-E. & M. van Wyk 2497* (JRAU)
Eriosema salignum E.Mey.; *B-E. & M. van Wyk 2754* (KSAN); *T. Saaiman 781* (PRE)
Indigofera L.
dimidiata Vogel ex Walp.; *B-E. & M. van Wyk 2719* (KSAN); *L.C.C. Liebenberg 7336* (PRE)
hedyantha Eckl. & Zeyh.; *B-E. & M. van Wyk 2816* (JRAU); *P.C. Zietsman 3245* (PRE)
hilaris Eckl. & Zeyh. var. **hilaris**; *P.C. Zietsman 2809* (PRE); *T. Saaiman 737* (PRE)
rostrata Bolus; *A. Spies 13* (PRE)
tristis E.Mey.; *Gertenbach & Groenewald 8854* (KSAN); *L.C.C. Liebenberg 7504* (PRE)
Lessertia DC.
capitata E.Mey.; *L.C.C. Liebenberg 7289* (PRE)
depressa Harv.; *B-E. & M. van Wyk 2779* (JRAU); *L.C.C. Liebenberg 6939* (PRE)
pauciflora Harv. var. **pauciflora**; *B.R. Roberts 3212* (PRE)
perennans (Jacq.) DC.
  var. **perennans**; *P.J. du Preez 2483* (PRE)
  var. **polystachya** (Harv.) L.Bolus; *L.C.C. Liebenberg 7277a* (PRE); *B.R. Roberts 3225* (PRE)
stricta L.Bolus; *B-E. & M. van Wyk 2524* (PRE); *A. Ueckermann 7039* (PRE)
Lotononis (DC.) Eckl. & Zeyh.
adpressa N.E.Br. subsp. **adpressa**; *B-E. & M. van Wyk 2648* (KSAN); *G. Germishuizen 717* (PRE)
calycina (E.Mey.) Benth.; *B-E. & M. van Wyk 2355* (KSAN); *L.C.C. Liebenberg 7528a* (PRE)
eriantha Benth.; *P.C. Zietsman 3247* (PRE)
foliosa Bolus; *L.C.C. Liebenberg 7548* (PRE)
lanceolata (E.Mey.) Benth.; *L.C.C. Liebenberg 7035* (PRE)
laxa Eckl. & Zeyh.; *B-E. & M. van Wyk 2410* (KSAN); *L.C.C. Liebenberg 6929* (PRE)
lotononoides (Scott-Elliot) B-E.van Wyk; *B-E. & M. van Wyk 2560* (KSAN); *G. Germishuizen 688* (PRE)
procumbens Bolus; *Gertenbach & Groenewald 9113* (KSAN); *L.C.C. Liebenberg 6943* (PRE)
sericophylla Benth.; *Gertenbach & Groenewald 8996* (PRE); *P.C. Zietsman 549* (PRE)
*__Medicago laciniata__ (L.) Mill. var. **laciniata**; *B-E. & M. van Wyk 2316* (KSAN)
*__Melilotus alba__ Desr.; *B-E. & M. van Wyk 2649* (KSAN); *Gertenbach & Groenewald 9158* (PRE)
Melolobium Eckl. & Zeyh.
alpinum Eckl. & Zeyh.; *Gertenbach & Groenewald 9206* (PRE); *G. Germishuizen 691* (PRE)
microphyllum (L.f.) Eckl. & Zeyh.; *B-E. & M. van Wyk 2354* (PRE); *Gertenbach & Groenewald 9004* (PRE)
Otholobium polystictum (Benth. ex Harv.) C.H.Stirt.; *B-E. & M. van Wyk 2343* (KSAN); *P.C. Zietsman 2992* (PRE)
Rhynchosia Lour.
caribaea (Jacq.) DC.; *B-E. & M. van Wyk 2829* (KSAN); *L.C.C. Liebenberg 6900* (PRE)
reptabunda N.E.Br.; *P.C. Zietsman 40* (PRE)
totta (Thunb.) DC. var. **totta**; *B-E. & M. van Wyk 2500* (KSAN); *P.C. Zietsman 3201* (PRE)
Sutherlandia R.Br. ex W.T.Aiton
frutescence (L.) R.Br.; *Daemane & Gerald 40* (KSAN)
montana E.Phillips & R.A.Dyer; *B-E. & M. van Wyk 2771* (KSAN)
Tephrosia Pers.
capensis (Jacq.) Pers. var. **capensis**; *L.C.C. Liebenberg 6805* (PRE); *P.C. Zietsman 2490* (PRE)
purpurea (L.) Pers. subsp. **leptostachya** (DC.) Brummitt var. **leptostachya**; *P.C. Zietsman 3000* (PRE)
semiglabra Sond.; *P.C. Zietsman 879* (PRE); *T. Saaiman 879* (PRE)
Trifolium L.
africanum Ser. var. **africanum**; *B-E. & M. van Wyk 2541* (PRE); *L.C.C. Liebenberg 6906* (PRE)
burchellianum Ser. subsp. **burchellianum**; *Gertenbach & Groenewald 8922* (KSAN); *D.C.H. Plowes 7064* (PRE)
*__Vicia__ L.
benghalensis L.; *J.J. Meyer 3176* (PRE)
sativa L. subsp. **sativa**; *Gertenbach & Groenewald 9190* (PRE); *T. Saaiman 850* (PRE)

FUMARIACEAE

Cysticapnos pruinosa (Bernh.) Lidén; *B.R. Roberts 3439* (BLFU)

GENTIANACEAE

Sebaea Sol. ex R.Br.
exigua (Oliv.) Schinz; *J.W. Potgieter 332* (BLFU)
filiformis Schinz; *P.C. Zietsman 498* (PRE)
grandis (E.Mey.) Steud.; *H. Bezuidenhout 707* (KSAN); *P.C. Zietsman 488* (PRE)
leiostyla Gilg.; *Gertenbach & Groenewald 710* (PRE); *B.R. Roberts 3097* (PRE)
minutissima Hilliard & B.L.Burtt; *H. Bezuidenhout 843* (KSAN)
natalensis Schinz; *Gertenbach & Groenewald 9002* (KSAN); *P.C. Zietsman 3024* (PRE)
rehmannii Schinz; *L.C.C. Liebenberg 6902* (PRE)
sedoides Gilg var. **confertiflora** (Schinz.) Marais; *J.W. Potgieter 331* (BLFU)

GERANIACEAE

Geranium L.
incanum Burm.f. var. **incanum**; *B-E. & M. van Wyk 2624* (KSAN); *L.C.C. Liebenberg 7337* (PRE)
magniflorum R.Knuth; *B.R. Roberts 3131* (PRE); *P.C. Zietsman 3330* (PRE)
robustum Kuntze; *Gertenbach & Groenewald 9022* (KSAN); *L.C.C. Liebenberg 7287* (PRE)
schlechteri R.Kunth; *B-E. & M. van Wyk 2549* (KSAN); *P.C. Zietsman 2885* (PRE)
wakkerstroomianum R.Knuth; *P.C. Zietsman 3286* (KSAN); *T. Saaiman 772* (PRE)
Monsonia brevirostrata R.Knuth; *B-E. & M. van Wyk 2860* (KSAN); *P.C. Zietsman 2907* (PRE)
Pelargonium L'Hér.
alchemilloides (L.) L'Hér.; *B-E. & M. van Wyk 2767* (KSAN); *Gertenbach & Groenewald 9106* (PRE)
bowkeri Harv.; *P.C. Zietsman 3567* (PRE); *L.C.C. Liebenberg 8238* (PRE)
grossularioides (L.) L'Hér.; *Gertenbach & Groenewald 9230* (PRE)
luridum (Andrews) Sweet; *B-E. & M. van Wyk 2577* (KSAN)
minimum (Cav.) Willd.; *B-E. & M. van Wyk 2353* (KSAN)

GESNERIACEAE

Streptocarpus Lindl.
gardenii Hook.; *L.C.C. Liebenberg 7569* (PRE)
polyanthus Hook. subsp. **dracomontanus** Hilliard; *B.R. Roberts 3429* (PRE)
pusillus Harv. ex C.B.Clarke; *B.R. Roberts 3267* (PRE); *L.C.C. Liebenberg 7569a* (PRE)

GREYIACEAE

Greyia sutherlandii Hook. & Harv.; *B-E. & M. van Wyk 2341* (KSAN); *Gertenbach & Groenewald 9198* (PRE)

GUNNERACEAE

Gunnera perpensa L.; *B-E. & M. van Wyk 2625* (KSAN); *B.R. Roberts 3425* (PRE)

ICACINACEAE

Cassinopsis ilicifolia (Hochst.) Kuntze; *B-E. & M. van Wyk 2386a* (KSAN); *Gertenbach & Groenewald 8973* (PRE)

LAMIACEAE

Acrotome inflata Benth.; *L. & P.C. Zietsman 527* (PRE)
Ajuga ophrydis Burch. ex Benth.; *B-E. & M. van Wyk 2384* (KSAN); *L.C.C. Liebenberg 7427* (PRE)
Mentha L.
aquatica L.; *B.R. Roberts 3292* (PRE)
longifolia (L.) Huds. subsp. **capensis** (Thunb.) Briq.; *B.R. Roberts 3307* (PRE); *L.C.C. Liebenberg 6843* (PRE)
Plectranthus grallatus Briq.; *B.R. Roberts 3239* (PRE); *L.C.C. Liebenberg 7475* (PRE)
Salvia repens Burch. ex Benth.
var. **repens**; *Gertenbach & Groenewald 8916* (KSAN); *S. Barendse 49* (KSAN)
var. **transvaalensis** Hedge; *P.C. Zietsman 2904* (PRE)
Stachys L.
dregeana Benth.; *L.C.C. Liebenberg 7039* (PRE); *B.R. Roberts 3103* (PRE)
grandifolia E.Mey. ex Benth.; *L.C.C. Liebenberg 7321* (PRE); *M.P.K. Meyer 7051* (PRE)
hyssopoides Burch. ex Benth.; *P.C. Zietsman 3329* (PRE)

LIMEACEAE

Limeum viscosum (J.Gay) Fenzl subsp. **viscosum** var. **glomeratum** (Eckl. & Zeyh.) Friedrich; *B.R. Roberts 3373* (PRE)

LINACEAE

Linum thunbergii Eckl. & Zeyh.; *B-E. & M. van Wyk 2526* (KSAN); *B.R. Roberts 3322* (PRE)

LOBELIACEAE

Cyphia oblongifolia Sond. & Harv.; *B.R. Roberts 3115* (PRE); *L.C.C. Liebenberg 7524* (PRE)
Lobelia L.
angolensis Engl. & Diels; *L.C.C. Liebenberg 6894* (PRE); *R.O. Moffett 5700* (PRE)
erinus L.; *B.R. Roberts 3138* (PRE); *P.C. Zietsman 533* (PRE)
flaccida (C.Presl.) A.DC. subsp. **flaccida**; *B-E. & M. van Wyk 2395* (KSAN); *Gertenbach & Groenewald 8924* (KSAN)
preslii A.DC., *L.C.C. Liebenberg 6991* (PRE)
Monopsis decipiens (Sond.) Thulin; *Gertenbach & Groenewald 8869* (PRE); *B.R. Roberts 3418* (PRE)

MALVACEAE

Hibiscus L.
aethiopicus L. var. **ovatus** Harv.; *Gertenbach & Groenewald 8896* (KSAN); *P.C. Zietsman 3238* (PRE)
trionum L., *B-E. & M. van Wyk 2547* (KSAN); *L.C.C. Liebenberg 7532* (PRE)
***Malva parviflora** L. var. **parviflora**; *B-E. & M. van Wyk 2843* (KSAN)

MELIANTHACEAE

Melianthus dregeanus Sond. subsp. **insignis** (Kuntze) S.A.Tansley; *M.L. Jacobs 8554* (PRE)

MESEMBRYANTHEMACEAE

Delosperma N.E.Br. emend. Lavis
ashtonii L.Bolus; *B-E. & M. van Wyk 2305* (KSAN)
congestum L.Bolus; *B.R. Roberts 3435* (PRE)
cooperi (Hook.f.) L.Bolus; *L.C.C. Liebenberg 7508* (PRE)
crassuloides (Haw.) L.Bolus; *P.C. Zietsman 3357* (PRE)
deleeuwiae Lavis; *B.R. Roberts 3410* (PRE)
hirtum (N.E.Br.) Schwantes; *L.C.C. Liebenberg 6919* (PRE)
lavisiae L.Bolus; *L.C.C. Liebenberg 7509* (PRE); *P.C. Zietsman 470* (PRE)
liebenbergii L.Bolus; *Gertenbach & Groenewald 8984* (KSAN); *L.C.C. Liebenberg 7509* (PRE)
wethamae L.Bolus; *B.R. Roberts 3411* (PRE)
Ruschia putterillii (L.Bolus) L.Bolus; *Gertenbach & Groenewald 699* (KSAN); *L.C.C. Liebenberg 7586* (PRE)

MOLLUGINACEAE

Pharnaceum detonsum Fenzl; *L.C.C. Liebenberg 6988* (PRE)

Psammotropha Eckl. & Zeyh.
mucronata (Thunb.) Fenzl
var. **foliosa** Adamson; *L.C.C. Liebenberg 6920* (PRE)
var. **marginata** Adamson; *B.R. Roberts 3304* (PRE); *P.C. Zietsman 3015* (PRE)
var. **mucronata**; *Gertenbach & Groenewald 8982* (PRE); *P.C. Zietsman 3558* (PRE)
myriantha Sond.; *L.C.C. Liebenberg 8220* (PRE)

MYRICACEAE

Morella serrata (Lam.) Killick; *B-E. & M. van Wyk 2881a* (KSAN); *P.C. Zietsman 2962* (PRE)

MYRSINACEAE

Myrsine africana L.; *B-E. & M. van Wyk 2324* (KSAN); *Gertenbach & Groenewald 8953* (PRE)
Rapanea melanophloeos (L.) Mez; *B-E. & M. van Wyk 2375a* (KSAN); *Gertenbach & Groenewald 9205* (KSAN)

OLEACEAE

***Ligustrum** sp.; *Gertenbach & Groenewald 9183* (KSAN)

OLINIACEAE

Olinia emarginata Burtt Davy; *B-E. & M. van Wyk 2374a* (KSAN); *Gertenbach & Groenewald 8961* (PRE)

ONAGRACEAE

Epilobium L.
capense Buchinger ex Hochst.; *J.W. Potgieter 110* (BLFU)
hirsutum L.; *L.C.C. Liebenberg 7527* (PRE)
salignum Hausskn.; *P.C. Zietsman 2981* (PRE); *L.C.C. Liebenberg 7495* (PRE)
***Oenothera** L.
biennis L.; *L.C.C. Liebenberg 7526* (PRE)
glazioviana Micheli; *L.C.C. Liebenberg 7445* (PRE); *D.J. Steyn 31* (PRE)
indecora Cambess. subsp. **indecora**; *B-E. & M. van Wyk 2688* (KSAN)
laciniata Hill; *P.C. Zietsman 3271* (PRE)
parodiana Munz subsp. **parodiana**; *L. & P.C. Zietsman 497* (PRE)
rosea L'Hér. ex Aiton; *B-E. & M. van Wyk 2350* (KSAN); *Gertenbach & Groenewald 8841* (KSAN)
stricta Ledeb. ex Link subsp. **stricta**; *B-E. & M. van Wyk 2784* (KSAN); *T. Saaiman 854* (PRE)
tetraptera Cav.; *Gertenbach & Groenewald 8908* (KSAN); *B.R. Roberts 3360* (PRE)

OROBANCHACEAE

Cycnium racemosum Benth.; *Gertenbach & Groenewald 9015* (KSAN); *B.R. Roberts 3285* (PRE)
Harveya Hook.
coccinea (Harv.) Schltr.; *B.R. Roberts 3129* (PRE)
speciosa Bernh.; *P.C. Zietsman 2909* (PRE)
Hyobanche sanguinea L.; *L.C.C. Liebenberg 7325* (PRE)
Sopubia cana Harv. var. **cana**; *Groenewald 8717* (PRE); *L.C.C. Liebenberg 6875* (PRE)
Striga Lour.
asiatica (L.) Kuntze; *L. & P.C. Zietsman 499* (PRE)
bilabiata (Thunb.) Kuntze subsp. **bilabiata**; *L.C.C. Liebenberg 6904* (PRE); *D.C.H. Plowes 7061* (PRE)
elegans Benth.; *Gertenbach & Groenewald 8910* (KSAN); *L.C.C. Liebenberg 6986* (PRE)

OXALIDACEAE

Oxalis L.
depressa Eckl. & Zeyh.; *B-E. & M. van Wyk 2397* (KSAN)
obliquifolia Steud. ex A.Rich.; *Gertenbach & Groenewald 9121* (KSAN); *L.C.C. Liebenberg 6808* (PRE)

PAPAVERACEAE

Papaver aculeatum Thunb.; *B-E. & M. van Wyk 2618* (KSAN); *Gertenbach & Groenewald 9160* (PRE)

PHYTOLACCACEAE

Phytolacca L.
heptandra Retz.; *B.R. Roberts 3329* (PRE)
octandra L.; *B-E. & M. van Wyk 2614* (KSAN)

PIPERACEAE

Peperomia tetraphylla (G.Forst.) Hook. & Arn.; *B-E. & M. van Wyk 2364a* (KSAN)

PITTOSPORACEAE

Pittosporum viridiflorum Sims; *B-E. & M. van Wyk 2371a* (KSAN); *Gertenbach & Groenewald 8968* (KSAN)

PLANTAGINACEAE

Plantago lanceolata L.; *Gertenbach & Groenewald 9182* (PRE)

POLYGALACEAE

Muraltia alticola Schltr.; *B-E. & M. van Wyk 2942* (PRE); *B.R. Roberts 3296* (PRE)
Polygala L.
  amatymbica Eckl. & Zeyh.; *J.W. Potgieter 475*(BLFU)
  gerrardii Chodat; *Gertenbach & Groenewald 8901* (KSAN); *P.C. Zietsman 2963* (PRE)
  gracilenta Burtt Davy; *B.R. Roberts 3032* (PRE); *Gertenbach & Groenewald 8866* (PRE)
  gymnoclada MacOwan; *Gertenbach & Groenewald 9008* (PRE)
  hispida Burch. ex DC.; *B-E. & M. van Wyk 2581* (KSAN); *Gertenbach & Groenewald 8870* (KSAN)
  hottentotta C.Presl; *B-E. & M. van Wyk 2383* (KSAN); *B.R. Roberts 3135* (PRE)
  ohlendorfiana Eckl. & Zeyh.; *B-E. & M. van Wyk 2528* (KSAN); *Gertenbach & Groenewald 8892* (PRE)
  rehmannii Chodat; *B-E. & M. van Wyk 2571* (KSAN); *T. Saaiman 835* (PRE)
  rhinostigma Chodat; *P.C. Zietsman 3564* (KSAN); *B.R. Roberts 3124* (PRE)
  uncinata E.Mey. ex Meisn.; *T. Saaiman 746* (PRE)
  virgata Thunb. var. **decora** (Sond.) Harv.; *Daemane & Gerald 11* (KSAN)

POLYGONACEAE

***Persicaria lapathifolia** (L.) Gray; *L.C.C. Liebenberg 7477* (PRE)
***Polygonum aviculare** L.; *B-E. & M. van Wyk 2761* (KSAN); *G. Germishuizen 4405* (PRE)
Rumex L.
  acetosella subsp. **angiocarpus** (Murb.) Murb.; *B-E. & M. van Wyk 2762* (KSAN); *Gertenbach & Groenewald 9126* (PRE)
  bequaertii De Wild.; *P.C. Zietsman 3234* (PRE)
  ***crispus** L.; *B-E. & M. van Wyk 2630* (KSAN); *Gertenbach & Groenewald 8917* (KSAN)
  lanceolatus Thunb.; *L.C.C. Liebenberg 6970* (PRE); *B.R. Roberts 3331* (PRE)
  steudelii Hochst. ex A.Rich.; *Gertenbach & Groenewald 9219* (PRE); *G. Germishuizen 4404* (PRE)
  woodii N.E.Br.; *Gertenbach & Groenewald 8849* (PRE)

PROTEACEAE

Protea L.
  caffra Meisn. subsp. **caffra**; *B-E. & M. van Wyk 2360* (KSAN); *Gertenbach & Groenewald 9185* (PRE)
  roupelliae Meisn. subsp. **roupelliae**; *B-E. & M. van Wyk 2333* (KSAN); *Gertenbach & Groenewald 9186* (PRE)
  subvestita N.E.Br.; *H. Bezuidenhout 700* (KSAN); *E.M. van Zinderen Bakker 18* (PRE)

RANANCULACEAE

Clematis brachiata Thunb.; *B.R. Roberts 3226* (PRE); *L.C.C. Liebenberg 7564* (PRE)
Ranunculus L.
  meyeri Harv.; *B-E. & M. van Wyk 2769* (KSAN)
  multifidus Forssk.; *B-E. & M. van Wyk 2478* (KSAN); *Gertenbach & Groenewald 9162* (PRE)
Thalictrum minus L.; *B.R. Roberts 3289* (PRE); *M.P.K. Meyer 7010* (PRE)

RHAMNACEAE

Rhamnus prinoides L'Hér.; *Gertenbach & Groenewald 9211* (KSAN)

ROSACEAE

Alchemilla woodii Kuntze; *J.C. Scheepers 1860* (PRE); *L.C.C. Liebenberg 6950* (PRE)
Cliffortia L.
  filicauloides Weim.; *B.R. Roberts 3441*(BLFU)
  linearifolia Eckl. & Zeyh.; *Daemane & Gerald 34* (KSAN); *P.C. Zietsman 2617* (PRE)
  nitidula (Engl.) R.E.Fr. & T.C.E.Fr. subsp. **pilosa** Weim.; *Gertenbach & Groenewald 8969* (PRE)
  ramosissima Schltr.; *J.W. Potgieter 334* (BLFU)
***Cotoneaster pannosus** Franch.; *T. Saaiman 848* (PRE)
Leucosidea sericea Eckl. & Zeyh.; *Gertenbach & Groenewald 8952* (PRE); *L.C.C. Liebenberg 8229* (PRE)
***Pyrus communis** L.; *P.C. Zietsman 3507* (PRE)
***Rosa rubiginosa** L.; *B-E. & M. van Wyk 2643* (KSAN)
Rubus L.
  ludwigii Eckl. & Zeyh. subsp. **ludwigii**; *B.R. Roberts 3391* (PRE); *R.G. Strey 2881* (PRE)
  rigidus Sm.; *L.C.C. Liebenberg 7272* (PRE); *M. Jacobs 8557* (PRE)

RUBIACEAE

Anthospermum L.
  herbaceum L.f.; *L.C.C. Liebenberg 6873* (PRE)
  rigidum Eckl. & Zeyh. subsp. **rigidum**; *L.C.C. Liebenberg 6945* (PRE)
  spathulatum Spreng. subsp. **spathulatum**; *B.R. Roberts 3121* (PRE)
Canthium ciliatum (Klotzsch) Kuntze; *Daemane & Gerald 07* (KSAN); *B.R. Roberts 3397* (PRE)
Galium L.
  capense Thunb.
    subsp. **capense**; *B.R. Roberts 3454* (PRE)
    subsp. **garipense** (Sond.) Puff; *L.C.C. Liebenberg 7044* (PRE)
  scabrelloides Puff; *M.P.K. Meyer 6970* (PRE)
  spurium L. subsp. **africanum** Verdc.; *Gertenbach & Groenewald 8899* (PRE)
  subvillosum Sond. var. **subvillosum**; *L.C.C. Liebenberg 6827* (PRE)
  thunbergianum Eckl. & Zeyh.
    var. **hirsutum** (Sond.) Verdc.; *P.C. Zietsman 2976* (PRE)
    var. **thunbergianum**; *B.R. Roberts 3221* (PRE); *M. Jacobs 8566* (PRE)
Kohautia amatymbica Eckl. & Zeyh.; *B-E. & M. van Wyk 2377* (KSAN); *P.C. Zietsman 3515* (PRE)
Pentanisia Harv.
  angustifolia (Hochst.) Hochst.; *P.C. Zietsman 2471* (PRE); *T. Saaiman 714* (PRE)
  prunelloides (Klotzsch ex Eckl. & Zeyh.) Walp.; *B-E. & M. van Wyk 2346* (KSAN); *L.C.C. Liebenberg 7331* (PRE)

Pygmaeothamnus chamaedendrum (Kuntze) Robyns var. **setulosus** Robyns; *T. Saaiman 868* (PRE); *P.C. Zietsman 3288* (PRE)

RUTACEAE

Clausena anisata (Willd.) Hook.f. ex Benth.; *B-E. & M. van Wyk 2368a* (KSAN)

SALICACEAE

***Populus alba** L.; *Gertenbach & Groenewald 9221* (PRE)
Salix L.
  ***babylonica** L. var. **babylonica**; *Gertenbach & Groenewald 9224* (KSAN)
  caprea L.; *M. Jacobs 8572* (PRE)
  ***fragilis** L. var. **fragilis**; *L. Henderson 898* (PRE)
Scolopia mundii (Eckl. & Zeyh.) Warb.; *B-E. & M. van Wyk 2379a* (KSAN); *P.C. Zietsman 35* (PRE)

SANTALACEAE

Osyris lanceolata Hochst. & Steud.; *Gertenbach & Groenewald 8971* (KSAN)
Thesium L.
  durum Hilliard & B.L.Burtt; *B.R. Roberts 3432* (PRE)
  imbricatum Thunb.; *P.C. Zietsman 3561* (PRE); *B.R. Roberts 3116* (PRE)
  macrogyne A.W.Hill; *L.C.C. Liebenberg 6928* (PRE)

SCROPHULARIACEAE

Aptosimum indivisum Burch. ex Benth.; *S. Barendse 20* (KSAN)
Diascia integerrima E.Mey. ex Benth.; *B.R. Roberts 3274* (PRE); *L.C.C. Liebenberg 6990* (PRE)
Diclis rotundifolia (Hiern) Hilliard & B.L.Burtt; *B.R. Roberts 3335* (PRE); *L.C.C. Liebenberg 7405* (PRE)
Glumicalyx Hiern
  apiculatus (E.Mey.) Hilliard & B.L.Burtt; *B.R. Roberts 3076* (PRE)
Glumicalyx Hiern (cont.)
  nutans (Rolfe) Hilliard & B.L.Burtt; *B.R. Roberts 3198* (PRE)
Halleria lucida L.; *B-E. & M. van Wyk 2320* (KSAN); *P.C. Zietsman 2969 (PRE)*

Hebenstretia L.
comosa Hochst.; *B.R. Roberts 3095* (PRE); *L.C.C. Liebenberg 6905* (PRE)
dentata L.; *M.J.Werger 1618* (PRE)
dura Choisy; *B-E. & M. van Wyk 2356a* (KSAN); *L.C.C. Liebenberg 6994* (PRE)
integrifolia L.; *B.R. Roberts 3108* (PRE)
Jamesbrittenia Kuntze
atropurpurea (Benth.) Hilliard subsp. **atropurpurea**; *B.R. Roberts 3104* (PRE)
aurantiaca (Burch.) Hilliard; *D.C.H. Plowes 7066* (PRE)
pristisepala (Hiern) Hilliard; *B.R. Roberts 3144* (PRE); *P.C. Zietsman 2894* (PRE)
stricta (Benth.) Hilliard; *L. & P.C. Zietsman 3574* (PRE)
Limosella maior Diels; *P.C. Zietsman 3574* (PRE)
Manulea L.
buchneroides Hilliard & B.L.Burtt; *S. Barendse 40* (KSAN)
crassifolia Benth.
subsp. **crassifolia**; *B.R. Roberts 3417* (BLFU)
subsp. **thodeana** (Diels) Hilliard; *B.R. Roberts 3336* (BLFU)
paniculata Benth.; *J.W. Potgieter 230* (BLFU)
Mimulus gracilis R.Br.; *T. Saaiman 871* (PRE)
Nemesia Vent.
caerulea Hiern; *L. & P.C. Zietsman 539* (PRE)
fruticans (Thunb.) Benth.; *Gertenbach & Groenewald 9009* (KSAN)
melissifolia Benth.; *B.R. Roberts 3249* (PRE)
rupicola Hilliard; *Groenewald & Daleen 8750* (PRE); *L.C.C. Liebenberg 7534* (PRE)
umbonata (Hiern) Hilliard & B.L.Burtt; *B.R. Roberts 3197* (PRE); *S Barendse 35* (KSAN)
Phygelius E.Mey. ex Benth.
aequalis Harv. ex Hiern; *Gertenbach & Groenewald 8943* (KSAN); *B.R. Roberts 3310* (PRE)
capensis E.Mey. ex Benth.; *B-E. & M. van Wyk 2362a* (KSAN); *L.C.C. Liebenberg 6903* (PRE)
Selago L.
densiflora Rolfe; *Gertenbach & Groenewald 9133* (KSAN); *B.R. Roberts 3008* (PRE)
flanaganii Rolfe; *Daemane & Gerald 17* (KSAN)
galpinii Schltr.; *Gertenbach & Groenewald 8742* (PRE); *D.G. Steyn 29* (PRE)
innata Markötter; *L.C.C. Liebenberg 8222* (PRE)
tenuifolia (Rolfe) Hilliard; *J.W. Potgieter 93* (BLFU)
Sutera Roth
floribunda (Benth.) Kuntze; *P.C. Zietsman 42* (PRE)
halimifolia (Benth.) Kuntze; *J. Engelbrecht 595* (NMB)
neglecta (J.M.Wood & M.S.Evans) Hiern; *B.R. Roberts 3078* (PRE); *R. Story 1953* (PRE)
polelensis Hiern subsp. **polelensis**; *B.R. Roberts 3383* (PRE); *L.C.C. Liebenberg 6809* (PRE)
Veronica anagallis-aquatica L.; *Gertenbach & Groenewald 8918* (KSAN); *B.R. Roberts 3309* (PRE)
Zaluzianskya F.W.Schmidt, nom. cons.
microsiphon (Kuntze) K.Schum.; *B.R. Roberts 3313* (PRE)
ovata (Benth.) Walp.; *B.R. Roberts 3366* (PRE)
pulvinata Killick; *J.C. Scheepers GG73* (PRE)
schmitziae Hilliard & B.L.Burtt; *L.C.C. Liebenberg 68591* (PRE); *B.R. Roberts 3050* (PRE)

SOLANACEAE

*__Datura ferox__ L.; *Gertenbach & Groenewald 9214* (KSAN)
*__Nierembergia linariifolia__ Graham var. **glabriuscula** (Dunal) Cocucci & Hunziker; *Gertenbach & Groenewald 9127* (KSAN)
Solanum L.
*__nigrum__ L.; *J.W. Potgieter 543* (BLFU); *B.R. Roberts 3257* (BLFU)
*__pseudocapsicum__ L.; *Gertenbach & Groenewald 8989* (PRE); *H. Bezuidenhout 690* (KSAN)
retroflexum Dunal; *B.R. Roberts 3262* (PRE); *L.C.C. Liebenberg 6877* (PRE)
Withania somnifera (L.) Dunal; *Gertenbach & Groenewald 8930* (PRE)

STERCULIACEAE

Hermannia L.
coccocarpa (Eckl. & Zeyh.) Kuntze; *S.Barendse 11* (KSAN)
cordata (E.Mey. ex E.Phillips) De Winter; *Gertenbach & Groenewald 8861* (PRE); *P.C. Zietsman 2873* (PRE)
depressa N.E.Br.; *B-E. & M. van Wyk 2675* (KSAN); *A.A. Mauve 4928* (PRE)
erodioides (Burch. ex DC.) Kuntze; *P.C. Zietsman 2879* (PRE)
geniculata Eckl. & Zeyh.; *R. Story 1955* (PRE)

THYMELAEACEAE

Gnidia L.
burchellii (Meisn.) Gilg; *Gertenbach & Groenewald 8993* (KSAN); *J.M. Anderson 1060* (PRE)
caffra (Meisn.) Gilg; *T. Saaiman 733* (PRE)
capitata L.f.; *L.C.C. Liebenberg 8237* (PRE)
fastigiata Rendle; *Groenewald & Daneel 8728* (PRE)
gymnostachya (C.A.Mey.) Gilg; *Gertenbach & Groenewald 8728* (KSAN)
kraussiana Meisn. var. **kraussiana**; *B-E. & M. van Wyk 2797* (KSAN); *B.R. Roberts 3176* (PRE)
Passerina montana Thoday; *B-E. & M. van Wyk 2364* (KSAN); *Gertenbach & Groenewald 9104* (PRE)

URTICACEAE

Urtica lobulata Blume; *Groenewald 8709* (PRE); *B.R. Roberts 3269* (PRE)

VALERIANACEAE

Valeriana capensis Thunb. var. **capensis**; *L.C.C. Liebenberg 6972* (PRE); *B.R. Roberts 3415* (PRE)

VERBENACEAE

*__Verbena rigida__ Spreng; *Gertenbach & Groenewald 9159* (KSAN)

VITACEAE

Rhoicissus tridentata (L.f.) Wild & R.B.Drumm. subsp. **cuneifolia** (Eckl. & Zeyh.) Urton; *B-E. & M. van Wyk 2865* (KSAN); *Gertenbach & Groenewald 9157* (PRE)

MONOCOTYLEDONS

AGAPANTHACEAE

Agapanthus campanulatus F.M.Leight. subsp. **patens** (F.M.Leight.) F.M.Leight.; *A. Spies PRE 35028* (PRE); *B.R. Roberts 3098* (PRE)

ALLIACEAE

Tulbaghia L.
acutiloba Harv.; *Gertenbach & Groenewald 8857* (KSAN); *L.C.C. Liebenberg 8235* (PRE)
leucantha Baker; *S. Barendse 6* (KSAN)

AMARYLLIDACEAE

Boophone disticha (L.f.) Herb.; *B-E. & M. van Wyk 2303* (KSAN); *Gertenbach & Groenewald 8997* (KSAN)
Cyrtanthus Aiton
contractus N.E.Br.; *S. Barendse 24*; *P.C. Zietsman 3565* (PRE)
stenanthus Baker var. **stenanthus**; *Gertenbach & Groenewald 8842* (PRE)
tuckii Baker
var. **transvaalensis** I.Verd.; *B-E. & M. van Wyk 2467* (KSAN); *Gertenbach & Groenewald 9018* (PRE)
var. **viridilobus** I.Verd.; *G.J. Lewis 6157* (PRE)
Haemanthus humilis Jacq. subsp. **hirsutus** (Baker) Snijman; *B-E. & M. van Wyk 2441* (KSAN); *L.C.C. Liebenberg 7313* (PRE)

ANTHERICACEAE

Chlorophytum fasciculatum (Baker) Kativu; *Gertenbach & Groenewald 8893* (PRE); *S. Barendse 42* (KSAN)

ARACEAE

Zantedeschia albomaculata (Hook.) Baill.
subsp. **albomaculata**; *Gertenbach & Groenewald 9147* (KSAN); *L.C.C. Liebenberg 7442* (PRE)
subsp. **macrocarpa** (Engl.) Letty; *B.R. Roberts 3146* (PRE)

ASPARAGACEAE

Asparagus L.
africanus Lam.; *P.C. Zietsman 3266* (PRE); *B.R. Roberts 3219* (PRE)
asparagoides (L.) Druce; *J.W. Potgieter 180* (BLFU); *B.R. Roberts 3230* (BLFU)

Asparagus L. (cont.)
microraphis (Kunth) Baker; *Daemane & Gerald 15* (KSAN)
plumosus Baker; *Gertenbach & Groenewald 8956* (PRE)
ramosissimus Baker; *Gertenbach & Groenewald 9169* (KSAN)

ASPHODELACEAE

Aloe L.
ecklonis Salm-Dyck; *B.R. Roberts 3446* (PRE); *L.C.C. Liebenberg 7443* (PRE)
greatheadii Schönland var. **davyana** (Schönland) Glen & D.S.Hardy; *B-E. & M. van Wyk 2340* (KSAN)
Bulbine Wolf
abyssinica A.Rich.; *P.C. & L. Zietsman 1357* (PRE)
capitata Poelln.; *Gertenbach & Groenewald 9145* (PRE)
favosa (Thunb.) Schult. & Schult.f.; *L.C.C. Liebenberg 7501* (PRE)
frutescens (L.) Willd.; *L.C.C. Liebenberg 7533a* (PRE)
lagopus (Thunb.) N.E.Br.; *B.R. Roberts 3184* (BLFU)
Kniphofia Moench
caulescens Baker; *J.C. Scheepers 5956* (PRE); *E.A. Bruce 395* (PRE)
porphyrantha Baker; *B-E. & M. van Wyk 2796* (KSAN); *B.R. Roberts 3451* (PRE)
ritualis Codd; *L.E.W. Codd 10537* (PRE); *B.R. Roberts 3452* (PRE)
triangularis Kunth subsp. **triangularis**; *J.C. Scheepers 1816* (PRE); *B.R. Roberts 3387* (PRE)
Trachyandra Kunth
asperata Kunth
var. **asperata**; *Gertenbach & Groenewald 9146* (PRE); *P.C. Zietsman 3568* (PRE)
var. **basutoensis** (Poelln.) Oberm.; *B.R. Roberts 3182* (PRE)
saltii (Baker) Oberm. var. **saltii**; *L.C.C. Liebenberg 7539* (PRE); *P.C. Zietsman 2821* (PRE)

COLCHICACEAE

Androcymbium striatum A.Rich.; *Gertenbach & Groenewald 9144* (PRE)
Littonia modesta Hook.; *Groenewald 8702* (PRE); *C.D. Blom 304* (PRE)

COMMELINACEAE

Commelina africana L. var. **lancispatha** C.B.Clarke; *L.C.C. Liebenberg 7447* (PRE); *B.R. Roberts 3030* (PRE)

CYPERACEAE

Abildgaardia ovata (Burm.f.) Kral; *L.C.C. Liebenberg 747* (PRE)
Ascolepis capensis (Kunth) Ridl.; *T. Saaiman 819* (PRE)
Bulbostylis Kunth
contexta (Nees) M.Bodard; *B.R. Roberts 3010* (PRE); *P.C. Zietsman 3168* (PRE)
humilis (Kunth) C.B.Clarke; *L.C.C. Liebenberg 6521* (PRE)
oritrephes (Ridl.) C.B.Clarke; *B.R. Roberts 3214* (PRE); *P.C. Zietsman 565* (PRE)
schoenoides (Kunth) C.B.Clarke; *Gertenbach & Groenewald 8823* (PRE)
scleropus C.B.Clarke; *S. Barendse 34* (PRE)
Carex L.
***acutiformis** Ehrh.; *L.C.C. Liebenberg 7319* (PRE); *T. Saaiman 843* (PRE)
cognata Kunth; *L.C.C. Liebenberg 7557* (PRE); *G. Germishuizen 4406* (PRE)
glomerabilis Krecs.; *P.C. Zietsman 2675* (PRE)
Cyperus L.
congestus Vahl; *Gertenbach & Groenewald 9200* (KSAN); *B.R. Roberts 3181* (PRE)
esculentus var. **esculentus**; *Gertenbach & Groenewald 9215* (PRE)
marginatus Thunb.; *L.C.C. Liebenberg 7555* (PRE); *M. Van Aswegen 16* (PRE)
obtusiflorus Vahl
var. **flavissimus** (Schrad.) Boeck.; *Gertenbach & Groenewald 8825* (PRE); *S. Barendse 31* (KSAN)
var. **obtusiflorus**; *B.R. Roberts 3214* (BLFU)
rigidifolius Steud.; *B.R. Roberts 3140* (PRE); *L.C.C. Liebenberg 7413* (PRE)
rotundus L.; *J.W. Potgieter 413* (BLFU)
rupestris Kunth var. **rupestris**; *R.D. Stam 214* (PRE)
schlechteri C.B.Clarke; *B.R. Roberts 3096* (PRE)
semitrifidus Schrad.; *B.R. Roberts 3039* (PRE); *P.C. Zietsman 3193* (PRE)
Eleocharis R.Br.
dregeana Steud.; *Gertenbach & Groenewald 9048* (PRE); *P.C. Zietsman 3233* (PRE)
stolonifera Boeck.; *L.C.C. Liebenberg 7413a* (PRE)
Fuirena Rottb.
coerulescens Steud.; *B.R. Roberts 3250* (BLFU)
pubescens (Poir.) Kunth. var. **pubescens**; *Gertenbach & Groenewald 8712* (KSAN); *B.R. Roberts 3250* (PRE)
Isolepis R.Br.
cernua (Vahl) Roem. & Schult. var. **cernua**; *Gertenbach & Groenewald 9173* (PRE); *L.C.C. Liebenberg 7530* (PRE)
costata A.Rich.; *Gertenbach & Groenewald 9044* (PRE); *B.R. Roberts 3295* (PRE)
Kyllinga Rottb.
erecta Schumach. var. **erecta**; *Gertenbach & Groenewald 8827* (PRE)
pauciflora Ridl.; *T. Saaiman 754* (PRE)
Pycreus P.Beauv.
macranthus (Boeck.) C.B.Clarke; *Gertenbach & Groenewald 8824* (KSAN); *B.R. Roberts 3180* (PRE)
mundii Nees; *L.C.C. Liebenberg 7440* (PRE)
nitidus (Lam.) J.Raynal; *J.W. Potgieter 478* (BLFU)
Schoenoxiphium Nees
basutorum Turrill; *Gertenbach & Groenewald 9047* (PRE)
madagascariense Cherm.; *P.C. Zietsman 2951* (PRE)
perdensum Kukkonen; *B.R. Roberts 3224* (PRE)
sparteum (Wahlenb.) C.B.Clarke; *Gertenbach & Groenewald 9081* (KSAN); *T. Saaiman 784* (PRE)
Schoenus nigricans L.; *P.C. Zietsman 76* (PRE); *R.D. Stam 207* (PRE)
Scirpoides burkei (C.B.Clarke) Goeth., Muasya & D.A.Simpson; *Gertenbach & Groenewald 9156* (KSAN); *L.C.C. Liebenberg 6889* (PRE)
Scirpus L.
falsus C.B.Clarke; *L.C.C. Liebenberg 7530a* (PRE)
ficinioides Kunth; *H. Bezuidenhout 751* (PRE); *L.C.C. Liebenberg 7491* (PRE)
Scleria woodii C.B.Clarke; *Gertenbach & Groenewald 9093* (KSAN); *B.R. Roberts 3087* (PRE)

DIOSCOREACEAE

Dioscorea sylvatica (Kunth) Eckl. var. **sylvatica**; *L.C.C. Liebenberg 6832* (PRE); *P.C. Zietsman 2971* (PRE)

ERIOSPERMACEAE

Eriospermum cooperi Baker var. **cooperi**; *B.R. Roberts 3464* (PRE)

HYACINTHACEAE

Dipcadi marlothii Engl.; *Gertenbach & Groenewald 8851* (PRE)
Drimia Jacq.
multisetosa (Baker) Jessop; *P.C. Zietsman 3554* (PRE)
sphaerocephala Baker; *Gertenbach & Groenewald 8831* (PRE); *B.R. Roberts 3204* (PRE)
Eucomis L'Hér.
autumnalis (Mill.) Chitt. subsp. **clavata** (Baker) Reyneke; *L.C.C. Liebenberg 7525a* (PRE)
bicolor Baker; *B.R. Roberts 3434* (PRE)
Galtonia Decne.
candicans Decne.; *L.C.C. Liebenberg 7562* (PRE)
viridiflora I.Verd.; *B.R. Roberts 3447* (PRE)
Ledebouria Roth
cooperi (Hook.f.) Jessop; *B-E. & M. van Wyk 2420* (KSAN); *B.R. Roberts 3271* (PRE)
marginata (Baker) Jessop; *H. Bezuidenhout 689* (KSAN); *P.C. Zietsman 3522* (PRE)
Merwilla plumbea (Lindl.) Speta; *Gertenbach & Groenewald 9172* (KSAN); *L.C.C. Liebenberg 7230* (PRE)
Ornithogallum L.
setosum (Jacq.) J.C.Manning & Goldblatt; *L.C.C. Liebenberg 7537a* (PRE); *P.C. Zietsman 3525* (PRE)
shawii (Baker) J.C.Manning & Goldblatt; *B.R. Roberts 3137* (PRE); *M.L. Jacobs 8563* (PRE)
tortile (Baker) J.C.Manning & Goldblatt; *L.C.C. Liebenberg 7339* (PRE)
Schizocarphus nervosus (Burch.) Van der Merwe; *Gertenbach & Groenewald 8846* (KSAN); *P.C. Zietsman 2831* (PRE)

HYPOXIDACEAE

Empodium elongatum (Nel) B.L.Burrt.; *P.C. Zietsman 3500* (PRE)
Hypoxis L.
acuminata Baker; *B-E. & M. van Wyk 2461*; *Gertenbach & Groenewald 9125* (PRE)
argentea Harv. ex Baker var. **argentea**; *Gertenbach & Groenewald 9120* (PRE); *P.C. Zietsman 3517* (PRE)

Hypoxis L. (cont.)
costata Baker; *B-E. & M. van Wyk 2463* (KSAN); *Gertenbach & Groenewald 9138* (PRE)
filiformis Baker; *L.C.C. Liebenberg 7499* (PRE); *S. Barendse 15* (KSAN)
gerrardii Baker; *J.W. Potgieter 325* (BLFU)
iridifolia Baker; *L.C.C. Liebenberg 7329* (PRE); *P.C. Zietsman 3165* (PRE)
obtusa Burch. ex Ker Gawl.; *J.W. Potgieter 109* (BLFU)
rigidula Baker var. **rigidula**; *Gertenbach & Groenewald 8925* (KSAN)
villosa L.f. var. **villosa**; *Gertenbach & Groenewald 8927* (KSAN); *Gertenbach & Groenewald 8898* (PRE)
Rhodohypoxis baurii (Baker) Nel var. **confecta** Hilliard & B.L.Burtt; *Gertenbach & Groenewald 8852* (PRE)

IRIDACEAE

Aristea Aiton
abyssinica Pax; *Gertenbach & Groenewald 8937* (PRE); *B-E. & M. van Wyk 2580* (KSAN)
montana Baker; *B.R. Roberts 3139* (PRE)
torulosa Klatt; *Gertenbach & Groenewald 8704* (KSAN, PRE)
Dierama K.Koch
cooperi N.E.Br.; *L.C.C. Liebenberg 8244* (PRE); *B.R. Roberts 3379* (PRE)
robustum N.E.Br.; *B.R. Roberts 3120* (PRE)
Gladiolus L.
crassifolius Baker; *H. Bezuidenhout 706* (KSAN); *B.R. Roberts 3119* (PRE)
dalenii Van Geel subsp. **dalenii**; *B.R. Roberts 3393* (PRE); *B. Geyser 2* (PRE)
elliotii Baker; *P.C. Zietsman 3235* (PRE)
longicollis Baker subsp. **platypetalus** (Baker) Goldblatt & J.C.Manning; *B-E. & M. van Wyk 2554* (KSAN); *Gertenbach & Groenewald 8844* (PRE)
papilio Hook.f.; *B-E. & M. van Wyk 2642* (KSAN); *Gertenbach & Groenewald 9150* (PRE)
permeabilis D.Delaroche subsp. **edulis** (Burch. ex Ker Gawl.) Oberm.; *Gertenbach & Groenewald 9229* (PRE); *B.R. Roberts 3081* (PRE)
saundersii Hook.f.; *J.W. Potgieter 369* (BLFU)
Hesperantha Ker Gawl.
baurii Baker subsp. **baurii**; *R. Story 1963* (PRE); *D.B. Muller* (NMB)
candida Baker; *L.C.C. Liebenberg 8227* (PRE)
coccinea (Backh. & Harv.) Goldblatt & J.C.Manning; *A. Spies 36106* (PRE); *A. Dieterlen 917* (PRE)
leucantha Baker; *L.C.C. Liebenberg 7011* (PRE)
Moraea Mill.
brevistyla (Goldblatt) Goldblatt; *P.C. Zietsman 3514* (KSAN); *B.R. Roberts 3403* (PRE)
huttonii (Baker) Oberm.; *H. Bezuidenhout 698* (KSAN); *P.C. Zietsman 37* (PRE)
modesta Killick; *S. Barendse 2* (KSAN); *P.C. Zietsman 58* (PRE)
robusta (Goldblatt) Goldblatt; *L.C.C. Liebenberg 7324* (PRE)
stricta Baker; *L.C.C. Liebenberg 8219* (PRE)
Tritonia lineata (Salisb.) Ker Gawl. var. **lineata**; *Gertenbach & Groenewald 8903* (KSAN); *L.C.C. Liebenberg 8239* (PRE)
Watsonia lepida N.E.Br.; *Gertenbach & Groenewald 8843* (PRE)

JUNCACEAE

Juncus L.
dregeanus Kunth; *Gertenbach & Groenewald 9045* (PRE)
exsertus Buchenau subsp. **exsertus**; *B.R. Roberts 3345* (PRE); *P.C. Zietsman 516* (PRE)
inflexus L.; *Gertenbach & Groenewald 9023* (PRE); *P.C. Zietsman 517* (PRE)
oxycarpus E.Mey. ex Kunth; *Gertenbach & Groenewald 9046* (KSAN)
punctorius L.f.; *Gertenbach & Groenewald 9007* (KSAN); *P.C. Zietsman 2616* (PRE)

ORCHIDACEAE

Brownleea Harv. ex Lindl.
galpinii Bolus subsp. **galpinii**; *R. Story 1964* (PRE)
macroceras Sond.; *D.J.B. Killick 4528* (PRE)
parviflora Harv. ex Lindl.; *J.W. Potgieter 360* (BLFU)
Corycium nigrescens Sond.; *B.R. Roberts 3444* (PRE)
Disa versicolor Rchb.f.; *A. Spies 35401* (PRE); *P.C. Zietsman 2793* (PRE)
Eulophia R.Br. ex Lindl.
aculeata (L.f.) Spreng. subsp. **huttonii** (Rolfe) A.V.Hall; *P.C. Zietsman 3315* (PRE)
foliosa (Lindl.) Bolus; *P.C. Zietsman 3174* (PRE)
hians Spreng.
var. **hians**; *L.C.C. Liebenberg 7274* (PRE); *P.C. Zietsman 2793* (PRE)
var. **nutans** (Sond.) S.Thomas; *J.P.H. Acocks 21944* (PRE)
ovalis Lindl. var. **ovalis**; *Gertenbach & Groenewald 9153* (KSAN)
Holothrix scopularia (Lindl.) Rchb.f.; *B.R. Roberts 3173* (PRE)
Satyrium Sw.
longicauda Lindl. var. **jacottetianum** (Kraenzl.) A.V.Hall; *B.R. Roberts 3421* (PRE)
neglectum Schltr. subsp. **neglectum**; *S. Venter 2876, 2884* (PRE)
parviflorum Sw.; *J.W. Potgieter 240* (BLFU)

POACEAE

Agrostis L.
barbuligera Stapf var. **longipilosa** Gooss. & Papendorf; *B.R. Roberts 3280* (PRE)
bergiana Trin. var. **bergiana**; *B.R. Roberts 3253* (PRE)
eriantha Hack. var. **eriantha**; *Gertenbach & Groenewald 9091* (PRE), *L.C.C. Liebenberg 7500* (PRE)
lachnantha Nees var. **lachnantha**; *B-E. & M. van Wyk 2868* (KSAN); *Gertenbach & Groenewald 9050* (PRE)
Andropogon L.
amethystinus Steud.; *R.P. Ellis 4996* (PRE)
appendiculatus Nees; *B-E. & M. van Wyk 2645* (KSAN); *Gertenbach & Groenewald 8808* (PRE)
distachyos L.; *Gertenbach & Groenewald 8880* (PRE); *P.C. Zietsman 557* (PRE)
ravus J.G.Anderson; *Gertenbach & Groenewald 9085* (PRE); *L.C.C. Liebenberg 7518* (PRE)
Aristida L.
bipartita (Nees) Trin. & Rupr.; *L.C.C. Liebenberg 6961*(PRE)
congesta Roem. & Schult.
subsp. **barbicollis** (Trin. & Rupr.) De Winter; *Gertenbach & Groenewald 9161* (KSAN); *P.C. Zietsman 568* (PRE)
subsp. **congesta**; *B-E. & M. van Wyk 2493* (KSAN); *Gertenbach & Groenewald 9094* (PRE)
diffusa Trin. subsp. **burkei** (Stapf) Melderis; *B-E. & M. van Wyk 2774* (KSAN); *Gertenbach & Groenewald 9096* (PRE)
junciformis Trin. & Rupr.
subsp. **galpinii** (Stapf) De Winter; *Gertenbach & Groenewald 8878* (KSAN); *P.C. Zietsman 3014* (PRE)
subsp. **junciformis**; *Gertenbach & Groenewald 9095* (PRE); *H. Bezuidenhout 757* (PRE)
***Avena fatua** L.; *B-E. & M. van Wyk 2766* (KSAN); *Gertenbach & Groenewald 9139* (PRE)
Brachiaria (Trin.) Griseb.
***advena** Vickery; *L.C.C. Liebenberg 6858* (PRE)
eruciformis (Sm.) Griseb.; *J.W. Potgieter 168* (BLFU)
marlothii (Hack.) Stent; *R. Story 5475* (KSAN)
serrata (Thunb.) Stapf ; *B-E. & M. van Wyk 2589* (KSAN); *Gertenbach & Groenewald 9060* (PRE)
Brachypodium P.Beauv.
bolusii Stapf; *B.R. Roberts 3065* (PRE); *L.C.C. Liebenberg 7488* (PRE)
flexum Nees; *B.R. Roberts 3332* (PRE); *L.C.C. Liebenberg 6828* (PRE)
Bromus L.
***catharticus** Vahl.; *B-E. & M. van Wyk 2603* (KSAN); *Gertenbach & Groenewald 8876* (PRE)
firmior (Nees) Stapf; *B-E. & M. van Wyk 2736* (KSAN); *Gertenbach & Groenewald 9090* (PRE)
speciosus Nees; *Gertenbach & Groenewald 8819* (PRE); *B.R. Roberts 3166* (PRE)
Catalepsis gracilis Stapf & Stent; *B-E. & M. van Wyk 2674* (KSAN); *Gertenbach & Groenewald 9149* (KSAN)
Chloris virgata Sw.; *G. Potts 4511* (PRE)
Cymbopogon Spreng.
caesius (Hook. & Arn.) Stapf; *Gertenbach & Groenewald 9192* (PRE)
dieterleniae Stapf ex E.Phillips; *B-E. & M. van Wyk 2653* (KSAN); *Gertenbach & Groenewald 9035* (PRE)
nardus (L.) Rendle; *Gertenbach & Groenewald 9061* (KSAN); *L.C.C. Liebenberg 7411* (PRE)
pospischilii (K.Schum.) C.E.Hubb.; *B-E. & M. van Wyk 2613* (KSAN); *Gertenbach & Groenewald 9092* (PRE)

- **Cymbopogon** Spreng. (cont.)
  - **prolixus** (Stapf) E.Phillips; *Gertenbach & Groenewald 8877* (PRE); *T. Saaiman 842* (PRE)
- **Cynodon** Rich.
  - **dactylon** (L.) Pers.; *B-E. & M. van Wyk 2686* (KSAN); *Gertenbach & Groenewald 9193* (PRE)
  - **hirsutus** Stent; *Gertenbach & Groenewald 9041* (PRE); *B.R. Roberts 3316* (PRE)
- *__Dactylis glomerata__ L.; *Gertenbach & Groenewald 9110* (KSAN)
- **Digitaria** Haller f.
  - **eriantha** Steud.; *Gertenbach & Groenewald 9087* (PRE)
  - **flaccida** Stapf; *B.R. Roberts 3014* (BLFU)
  - **monodactyla** (Nees) Stapf; *B-E. & M. van Wyk 2583* (KSAN); *Gertenbach & Groenewald 9063* (PRE)
  - **natalensis** Stent; *L.C.C. Liebenberg 7459* (KSAN); *B.R. Roberts 3013* (PRE)
  - *__sanguinalis__ (L.) Scop.; *B.R. Roberts 3167* (PRE)
  - **setifolia** Stapf; *J.W. Potgieter 210* (BLFU)
  - **ternata** (A.Rich.) Stapf; *P.C. Zietsman 529* (PRE)
  - **tricholaenoides** Stapf; *B-E. & M. van Wyk 2611* (KSAN); *B.R. Roberts 3951* (PRE)
- **Diheteropogon filifolius** (Nees) Clayton; *B-E. & M. van Wyk 2485* (KSAN); *B.R. Roberts 3062* (PRE)
- **Ehrharta** Thunb.
  - **erecta** Lam.
    - var. **erecta**; *B.R. Roberts 3236* (PRE); *L.C.C. Liebenberg 7455* (PRE)
    - var. **natalensis** Stapf; *Gertenbach & Groenewald 9202* (PRE)
  - **longigluma** C.E.Hubb.; *R. Story 961* (PRE); *H.C. Taylor 1506* (PRE)
- **Elionurus muticus** (Spreng.) Kuntze; *B-E. & M. van Wyk 2484* (KSAN); *Gertenbach & Groenewald 8812* (PRE)
- **Enneapogon desvauxii** P.Beauv.; *J.W. Potgieter 433* (BLFU)
- **Eragrostis** Wolf
  - **caesia** Stapf; *H. Bezuidenhout 754* (PRE); *L. & P.C. Zietsman 485* (PRE)
  - **capensis** (Thunb.) Trin.; *B-E. & M. van Wyk 2388* (KSAN); *Gertenbach & Groenewald 8804* (PRE)
  - **chloromelas** Steud.; *Gertenbach & Groenewald 9030* (PRE); *L.C.C. Liebenberg 6822* (PRE)
  - **curvula** (Schrad.) Nees; *B-E. & M. van Wyk 2548* (KSAN); *Gertenbach & Groenewald 8884* (PRE)
  - **gummiflua** Nees; *J.W. Potgieter 216* (BLFU)
  - **heteromera** Stapf; *L.C.C. Liebenberg 7558* (PRE)
  - **lehmanniana** Nees var. **lehmanniana**; *B-E. & M. van Wyk 2654* (KSAN)
  - **obtusa** Munro ex Ficalho & Hiern; *J.W. Potgieter 431* (BLFU)
  - **patentissima** Hack.; *P.C. Zietsman 3007* (PRE)
  - **plana** Nees; *B-E. & M. van Wyk 2672* (KSAN); *Gertenbach & Groenewald 9037* (PRE)
  - **planiculmis** Nees; *Gertenbach & Groenewald 9140* (KSAN); *L.C.C. Liebenberg 7412* (PRE)
  - **racemosa** (Thunb.) Steud.; *B-E. & M. van Wyk 2495* (KSAN); *Gertenbach & Groenewald 9076* (PRE)
  - **sclerantha** Nees subsp. **sclerantha**; *J.W. Potgieter 201* (BLFU)
  - *__tef__ (Zucc.) Trotter; *B-E. & M. van Wyk 2590* (KSAN); *L.C.C. Liebenberg 7495* (PRE)
  - **trichophora** Coss. & Durieu; *A.P. Goossens 1085* (PRE)
- **Festuca** L.
  - **caprina** Nees; *L.C.C Liebenberg 7570* (PRE); *B.R. Roberts 3365* (PRE)
  - **costata** Nees; *B-E. & M. van Wyk 2712* (KSAN); *Gertenbach & Groenewald 8886* (PRE)
  - **longipes** Stapf; *Gertenbach & Groenewald 9100* (KSAN); *B. van Ginkel 353* (PRE)
  - **scabra** Vahl; *Gertenbach & Groenewald 9082* (PRE); *T. Saaiman 766* (PRE)
- **Fingerhuthia sesleriiformis** Nees; *B-E. & M. van Wyk 2864* (KSAN); *Gertenbach & Groenewald 9066* (PRE)
- **Harpochloa falx** (L.f.) Kuntze; *B-E. & M. van Wyk 2419* (KSAN); *Gertenbach & Groenewald 8821* (PRE)
- **Helictotrichon** Schult.
  - **dodii** (Stapf) Schweick.; *B.R. Roberts 3163* (PRE)
  - **hirtulum** (Steud.) Schweick.; *B.R. Roberts 3222* (BLFU)
  - **longifolium** (Nees) Schweick.; *J.C. Scheepers 1820* (PRE)
  - **turgidulum** (Stapf) Schweick.; *Gertenbach & Groenewald 8879* (PRE); *B.R. Roberts 3044* (PRE)
- **Hemarthria altissima** (Poir.) Stapf & C.E.Hubb.; *Gertenbach & Groenewald 8746* (PRE); *A.P. Goossens 1263* (PRE)
- **Heteropogon contortus** (L.) Roem. & Schult.; *Gertenbach & Groenewald 8820* (PRE); *H. Bezuidenhout 756* (KSAN)
- **Hyparrhenia** E.Fourn.
  - **dregeana** (Nees) Stapf ex Stent; *Gertenbach & Groenewald 9072* (PRE); *L.C.C. Liebenberg 6820* (KSAN)
  - **hirta** (L.) Stapf; *B-E. & M. van Wyk 2492* (KSAN); *Gertenbach & Groenewald 9069* (PRE)
  - **quarrei** Robyns; *B-E van Wyk 2872* (KSAN)
- **Imperata cylindrica** (L.) Raeusch.; *B-E. & M. van Wyk 2607* (KSAN); *Gertenbach & Groenewald 9151* (PRE)
- **Karroochloa purpurea** (L.f.) Conert & Türpe; *B-E. & M. van Wyk 2365* (KSAN); *Gertenbach & Groenewald 9088* (PRE)
- **Koeleria capensis** (Steud.) Nees; *B-E. & M. van Wyk 2567* (KSAN); *Gertenbach & Groenewald 9064* (PRE)
- *__Lolium__ L.
  - **multiflorum** Lam.; *B-E. & M. van Wyk 2717* (KSAN)
    - × **perenne** L.; *Gertenbach & Groenewald 9049* (PRE)
  - **temulentum** L.; *J.W. Potgieter 203* (BLFU)
- **Melica** L.
  - **decumbens** Thunb.; *J.C. Scheepers 1822* (PRE)
  - **racemosa** Thunb.; *B.R. Roberts 3428* (PRE); *L.C.C. Liebenberg 6847* (PRE)
- **Melinis** P.Beauv.
  - **nerviglumis** (Franch.) Zizka; *B-E. & M. van Wyk 2496* (KSAN); *Gertenbach & Groenewald 8881* (PRE)
  - **repens** (Willd.) Zizka subsp. **repens**; *B-E. & M. van Wyk 2612* (KSAN)
- **Merxmuellera** Conert
  - **disticha** (Nees) Conert; *Roberts 3156* (PRE); *L.C.C. Liebenberg 6964* (PRE)
  - **drakensbergensis** (Schweick.) Conert; *J.W. Potgieter 42* (BLFU); *B.R. Roberts 3388* (BLFU)
  - **macowanii** (Stapf) Conert; *R.P. Ellis 2394* (PRE)
  - **stereophylla** (J.G.Anderson) Conert; *B.R. Roberts 3152* (PRE); *L.C.C. Liebenberg 6963* (PRE)
  - **stricta** (Schrad.) Conert; *B-E. & M. van Wyk 2739* (KSAN); *B.R. Roberts 3301* (PRE)
- **Microchloa caffra** Nees; *B-E. & M. van Wyk 2579* (KSAN); *Gertenbach & Groenewald 8805* (PRE)
- **Miscanthus capensis** (Nees) Andersson; *G. Potts 4525* (PRE); *B.R. Roberts 3164* (PRE)
- **Monocymbium ceresiiforme** (Nees) Stapf; *H. Bezuidenhout 761* (KSAN); *Gertenbach & Groenewald 9057* (PRE)
- **Panicum** L.
  - **coloratum** L. var. **coloratum**; *J.W. Potgieter 199* (BLFU)
  - **ecklonii** Nees; *B-E. & M. van Wyk 2582* (KSAN); *Gertenbach & Groenewald 9051* (PRE)
  - **natalense** Hochst.; *Gertenbach & Groenewald 9179* (PRE); *P.C. Zietsman 3169* (PRE)
  - **schinzii** Hack.; *B-E. & M. van Wyk 2848* (KSAN); *Gertenbach & Groenewald 9073* (PRE)
- *__Paspalum dilatatum__ Poir.; *B-E. & M. van Wyk 2563* (KSAN); *Gertenbach & Groenewald 9052* (PRE)
- **Pennisetum** Rich.
  - **sphacelatum** (Nees) T.Durand & Schinz; *Gertenbach & Groenewald 9068* (PRE); *B.R. Roberts 3066* (PRE)
  - **thunbergii** Kunth; *B-E. & M. van Wyk 2635* (PRE); *Gertenbach & Groenewald 8875* (PRE)
- **Pentaschistis** (Nees) Spach
  - **airoides** (Nees) Stapf subsp. **jugorum** (Stapf) H.P.Linder; *L.C.C. Liebenberg 7492* (PRE); *R Story 1962* (PRE)
  - **basutorum** Stapf; *Gertenbach & Groenewald 9027* (PRE); *B.R. Roberts 3388* (PRE)
  - **oreodoxa** Schweick.; *L.C.C. Liebenberg 7515* (PRE)
  - **setifolia** (Thunb.) McClean; *L.C.C. Liebenberg 6908* (PRE); *B.R. Roberts 3157* (PRE)
- *__Phalaris arundinacea__ L.; *Gertenbach & Groenewald 9043* (PRE); *Groenewald & Daleen 8730* (PRE)
- **Phragmites australis** (Cav.) Steud.; *P.C. Zietsman 521* (PRE); *G. Potts 4522* (PRE)
- **Poa** L.
  - *__annua__ L.; *L.C.C. Liebenberg 7338* (PRE)
  - **binata** Nees; *B-E. & M. van Wyk 2414* (KSAN); *Gertenbach & Groenewald 8822* (PRE)
  - *__pratensis__ L.; *Gertenbach & Groenewald 9034* (KSAN)
- *__Polypogon viridis__ (Gouan) Breistr.; *B-E. & M. van Wyk 2863* (KSAN)
- **Rendlia altera** (Rendle) Chiov.; *B-E. & M. van Wyk 2370* (KSAN); *Gertenbach & Groenewald 8818* (PRE)
- **Setaria** P.Beauv.
  - **nigrirostris** (Nees) T.Durand & Schinz; *B-E. & M. van Wyk 2848* (KSAN); *Gertenbach & Groenewald 8885* (PRE)

Setaria P.Beauv. (cont.)
  pumila (Poir.) Roem. & Schult.; *B-E. & M. van Wyk 2870* (KSAN); *Gertenbach & Groenewald 9070* (PRE)
  sphacelata (Schumach.) Moss
    var. **sphacelata**; *B-E. & M. van Wyk 2489* (KSAN); *Gertenbach & Groenewald 9099* (PRE)
    var. **torta** (Stapf) Clayton; *Gertenbach & Groenewald 8814* (PRE); *P.C. Zietsman 3018* (PRE)
Sporobolus R.Br.
  africanus (Poir.) Robyns & Tournay; *B-E. & M. van Wyk 2610* (KSAN)
  centrifugus (Trin.) Nees; *B-E. & M. van Wyk 25845* (KSAN); *Gertenbach & Groenewald 9062* (KSAN)
Stiburus Stapf
  alopecuroides (Hack.) Stapf; *Gertenbach & Groenewald 9042* (PRE); *H. Bezuidenhout 755* (PRE)
  conrathii Hack.; *Gertenbach & Groenewald 9033* (KSAN); *L.C.C. Liebenberg 7322* (PRE)
Stipagrostis zeyheri (Nees) De Winter subsp. **sericans** (Hack.) De Winter; *Gertenbach & Groenewald 9079* (KSAN)
Streblochaete longiarista (A.Rich.) Pilg.; *N. Grobbelaar 2094* (PRE)
Themeda triandra Forssk.; *Gertenbach & Groenewald 8803* (PRE); *B.R. Roberts 3060* (PRE)
Trachypogon spicatus (L.f.) Kuntze; *B-E. & M. van Wyk 2490* (KSAN); *Gertenbach & Groenewald 9074* (PRE)
Tragus Haller
  koelerioides Asch.; *Groenewald & Daneel 8744* (PRE)
  racemosus (L.) All.; *L.C.C. Liebenberg 7540* (PRE)
Trichoneura grandiglumis (Nees) Ekman; *Gertenbach & Groenewald 9098* (PRE)
Tristachya leucothrix Nees; *Gertenbach & Groenewald 8807* (PRE); *B.R. Roberts 3172* (PRE)
Urochloa panicoides P.Beauv.; *Gertenbach & Groenewald 9078* (PRE); *L.C.C. Liebenberg 6851* (PRE)

RESTIONACEAE

Ischyrolepis schoenoides (Kunth) H.P.Linder; *B.R. Roberts 3389* (PRE); *L. & P.C. Zietsman 43* (PRE)

VELLOZIACEAE

Xerophyta viscosa Baker; *Gertenbach & Groenewald 8988* (PRE); *B.R. Roberts 3218* (PRE)

XYRIDACEAE

Xyris capensis Thunb.; *B.R. Roberts 3011* (PRE)

Bothalia 40,2: 219–226 (2010)

How homogeneous is West Coast Renosterveld? Implications for conservation

I.P. NEWTON* and R.S. KNIGHT**

Keywords: cluster analysis, conservation, extinction, fragmentation, homogeneity, South Africa, West Coast Renosterveld

ABSTRACT

In this paper, we test two published assumptions about West Coast Renosterveld, a highly fragmented vegetation type in South Africa. The first is that it is a homogeneous vegetation type. The second is that small fragments are subsets (in terms of species) of the larger fragments. We used three sets of data. Species lists showed that more than 44 % of the species identified at 16 sites were unique to that site. Examining the dominant and rare species occurring at subsites within large fragments showed that, on average three-quarters, and never less than half, of the species were confined to one subsite. Analyses of rare and endangered plant species lists showed that the average distance separating patches of the same species was almost 30 km. Only 36.4 % of the rare or endangered species localities coincided with a major (> 25 ha) fragment. Our first conclusion was that many endemic species are constrained by micro- or meso-habitat demands that are not immediately obvious to the observer, and hence the vegetation should not be considered locally homogeneous. Our second conclusion was that the smaller fragments (< 25 ha) are of importance for the conservation of West Coast Renosterveld plant species.

INTRODUCTION

West Coast Renosterveld (WCR) is arguably the most highly transformed vegetation type within South Africa (Reyers *et al.* 2001; Rouget *et al.* 2003), with between 5 % (Von Hase *et al.* 2003) and 9.4 % (Newton & Knight 2005) remaining. Despite this, Rebelo (1995) observed that when species lists from the 1700s and from today were compared, no extinctions had been reported. One of the three suggestions that he made as to the reason for this, was that renosterveld was homogeneous, and localized endemic species were therefore rare or absent. As a corollary, he suggested that this would imply that even rare species would have a wide distributional range within specialized habitats. Bond & Goldblatt (1984), and Kemper *et al.* (1999), have both suggested that coastal renosterveld is home to many local endemics, with Von Hase *et al.* (2003) recording 132 such species from the Boland/Swartland Coastal Renosterveld Broad Habitat Units (BHU) (Cowling & Heijnis 2001). Von Hase *et al.* (2003) in their conservation plan for coastal renosterveld, rightly observed that due to its fragmented nature, only a limited number of fragments could be financially conserved. However, they also made the assumption that the smaller fragments were merely subsets of the major fragments, and that by conserving the larger fragments, one was effectively conserving most species. We set out to test these assumptions, using three sets of data. WCR was divided by Cowling & Heijnis (2001) into two major habitat units, and it has recently been further subdivided into five subtypes (Mucina & Rutherford 2004). Since management plans were designed around this vegetation type as an entity (Von Hase *et al.* 2003), we are restricting our examination to the single, larger, more recognized unit. Figure 1 shows the location of the sites mentioned in the text.

METHODS

Three sets of data were used to estimate the level of homogeneity within WCR. In the first case, species lists, mainly from published sources, were used (Table 1). The data were entered into an EXCEL spreadsheet, their taxonomy checked (Harvey & Sonder 1859–1860, 1894a, b; Thiselton-Dyer 1896, 1897, 1904, 1909, 1912, 1913, 1925; Gibbs Russell *et al.* 1985, 1987, 1990; Arnold & De Wet 1993; Goldblatt & Manning 2000; Germishuizen & Meyer 2003) and aliens excluded. In total, 1 510 indigenous species were identified. Forty-four other species could not be traced to recent taxonomic works and were excluded from the analyses.

To determine plant-community relationships between the different sites, resemblance matrices for each of three groups (see below) were constructed using the Sorenson Coefficient method. This method ignores 0–0 similarities when performing pair-wise comparisons, and doubly weights 1–1 agreements. The presence of a species in a pair of sites counts as a definite similarity, whereas its absence may be due to a genuine absence, or to collecting effort. The sites were clustered using the 'unweighted pair-group method using arithmetic averages' (UPGMA) as described in Romesburg (1984). Distortions introduced by the clustering method were tested by using the cophenetic correlation coefficient (Romesburg 1984). Twenty-one sites were analysed. For the first analysis, the data were divided into five individual sites plus two regional sites (Darling and Southwest), these two regional groupings consisting of sites located close together and predominantly of the same substrate type (granite for Darling, shale for Southwest). The individual sites within each of the two regional groups of the first analysis were then analysed separately to determine site relationships within those groups. Ten sites made up the Darling region and six the Southwest region.

The second set of data used was that collected by the Botanical Society during their Lowland Renosterveld Conservation project. This data set was analysed on a simple number of species/unique species per site or

---

* Correspondence author. Current address: Department of Archaeology, University of Cape Town, Rondebosch, 7700, Cape Town. e-mail: ian.newton@uct.ac.za.

** Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville 7530, Cape Town.

MS. received: 2008-10-02.

TABLE 1.—Species lists used for cluster analyses

Site	Author(s)	Type and quality
Blouberg	Tansley 1982	Very superficial
Darling Hills	Heydenrych & Littlewort 1995	Authors estimated a 13 % error
Dassenberg and Klein Dassenberg	Kilian 1995	Amalgamation 'relatively good, but missing many species'
Eensaamheid	McDowell 1995	Detailed study; good
Elandsberg PNR	Mrs Elizabeth Parker	Private list; detailed
Paarlberg	Prof. Suzanne Milton	Private amalgamation; good
Signal Hill	Joubert & Moll 1992	Detailed study + other published lists; good
Stellenbosch	Duthie 1930	Detailed study; good
Stellenbosch	Levyns 1929	1 022 m^2 site; good within site
Tienie-Versfeld Reserve	Hilton-Taylor 1993*	NBI field excursion list; reasonable
Tygerberg, Meerendal, Hoogekraal and Kanonkop	Wood & Low 1993	Amalgamation; good
Voelvlei	Tansley 1982	Very superficial

* List reproduced in Heydenrych & Littlewort 1995.

subsite. The third set of data was that maintained by the CREW (Custodians of Rare and Endangered Wildflowers) project. These data record the locations and environmental conditions of rare and endangered plant species. The average distance between populations of the same species or subspecies was calculated, using the coordinates supplied, and the theorem of Pythagoras. An average great-circle distance per degree of 92.7 km E–W and 111.2 km N–S, being that of 33.5°S and 18.5°E, was used. Variations in these distances over the area examined would be insignificant when compared to species location errors and undulations of the earth. Finally the locations were plotted on a map of the remaining fragments of > 3 ha and > 25 ha (Newton & Knight 2005), and the number of species coinciding with these assessed.

RESULTS

Based upon published data, Table 2 suggests that there is a very high level of local endemism within each of the sites analysed. In the all-areas analysis, only three species were common to all seven sites, and 52.3 % of the species were confined to single sites. Looking at the Southwest region, half the species were again confined to single sites, and only seven were found at all six sites. The Darling region showed a slightly lower proportion of species confined to one site (44.5 %) and eight species occurred in all ten sites. The cluster tree (Figure 1) shows the relationship of the sites to one another. The main grouping (Figure 2A) reflects the high level of endemism indicated in Table 2. The two most similar sites are the two regional sites, which, since they consist of 16 subsites, might be expected to contain a

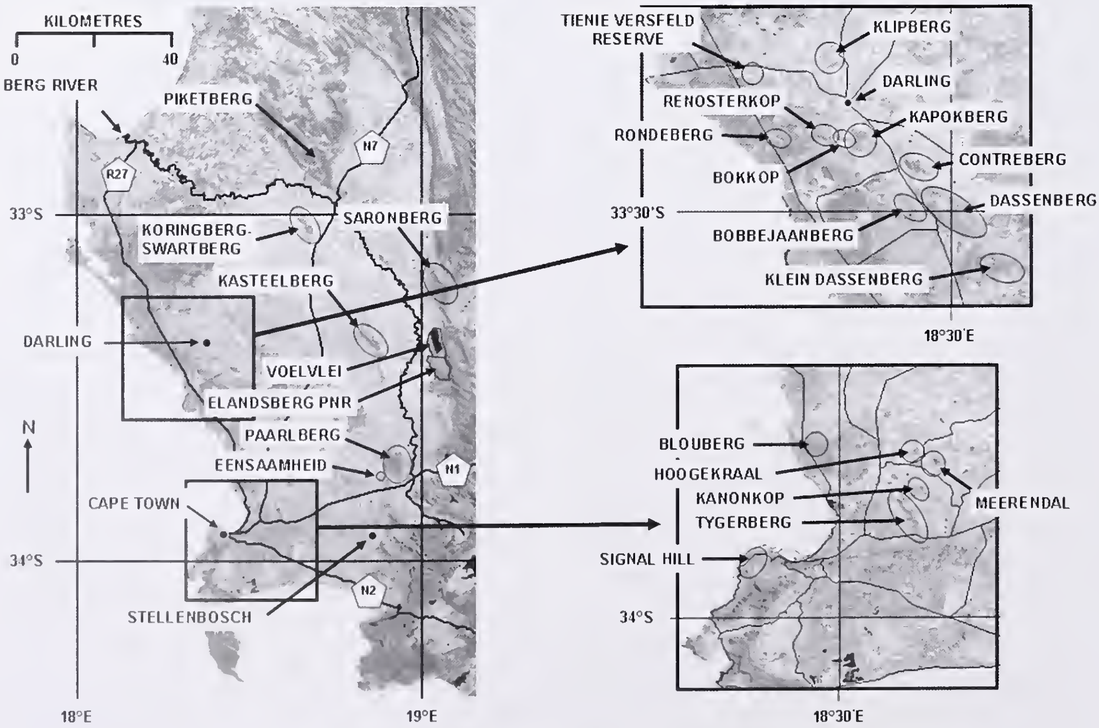


FIGURE 1.—Map of region showing sites referred to in text and tables.

TABLE 2.—No. and percentage of plant species common to study sites used for preliminary assessment of diversity of West Coast Renosterveld

	All		Southwest		Darling	
	No.	%	No.	%	No.	%
Total no. sites	7		6		10	
Species common to all 10 sites	-	-	-	-	8	1.2
Species common to any 9 sites	-	-	-	-	26	4.1
Species common to any 8 sites	-	-	-	-	17	2.7
Species common to any 7 sites	3	0.2	-	-	23	3.6
Species common to any 6 sites	30	2.0	7	1.0	31	4.8
Species common to any 5 sites	61	4.0	30	4.4	33	5.1
Species common to any 4 sites	99	6.6	68	10.0	42	6.6
Species common to any 3 sites	192	12.7	96	14.2	58	9.0
Species common to any 2 sites	336	22.3	139	20.5	118	18.4
Species found at only 1 site	1 025	52.3	338	49.9	285	44.5
Total no. species	1 510		678		641	

large number of shared species. In the Southwest region (Figure 2B), the two features to note are that Signal Hill is more closely clustered with the Tygerberg than are Meerendal and Hoogekraal (which are physically closer to Tygerberg), and the distant positioning of Blouberg. In the Darling region (Figure 2C), the similarities between the hills were generally higher than elsewhere. The three sites showing the greatest similarity (Bokkop, Renosterkop and Kapokberg) lie adjacent to each other and have a similar linear extent (NW to SE) as the Tygerberg. The Dassenberg and Klein Dassenberg form a separate group, probably because of their mixed geological origins, and hence floristic community possibilities. Note the outlying Tienie Versfeld Reserve, which

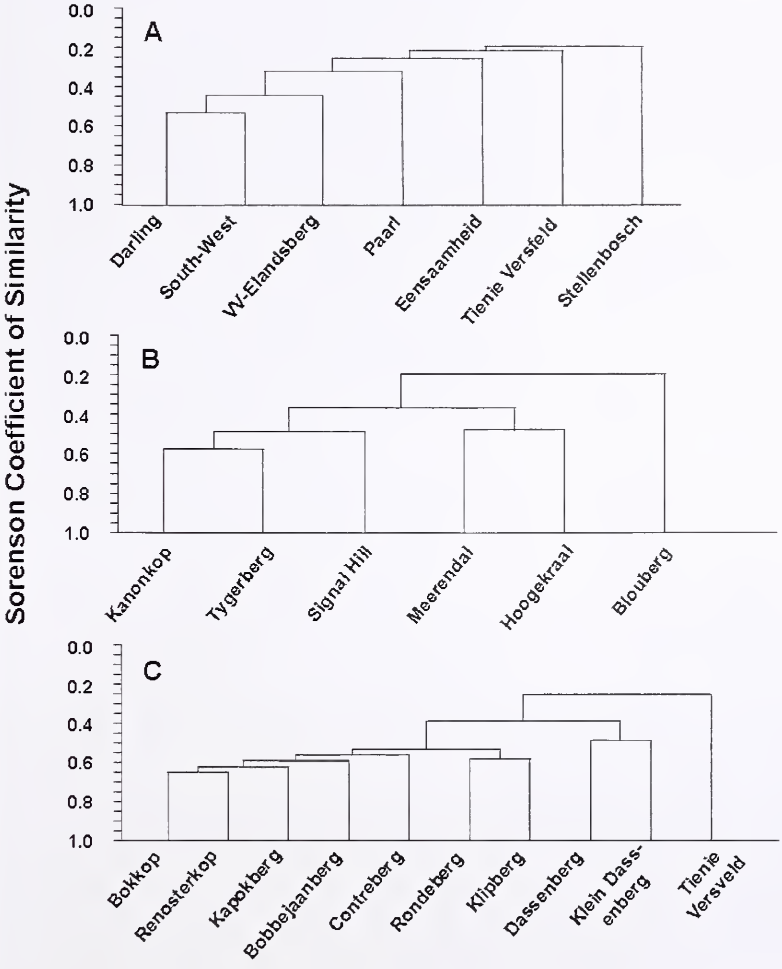


FIGURE 2.—Cluster analyses showing species community relationships between sites for which species lists were available. A, major sites; B, sites from Southwest region; C, sites from Darling region.

will be discussed later. The cophenetic correlation coefficients (r) for the three groups ranged between 0.94 and 0.97, indicating that there was very little distortion introduced during the clustering process (Romesburg 1984).

With respect to the lowlands renosterveld data collected by the Botanical Society, the results supported the findings described above. Of the 135 fragments sampled, 114 were described as renosterveld, and the analyses were confined to these. Two hundred and fifty-four indigenous species were listed, 109 of which (42.9 %) were found only at one site. Two hundred and nine species (82.3 %) were found at five or less sites. Only five species were found at more than twenty sites, these being *Eriocephalus africanus* (72 sites), *Elytropappus rhinocerotis* (69 sites), two species of *Ehrharta* (*thunbergii* and *calycina)* at 41 and 36 sites respectively, and *Cotula turbinata* at 26 sites.

In the CREW endangered species data list, 1 448 records of 184 species distributed over 1 037 unique sites were used. Thirty-two species were recorded from single sites only, and 102 species (55.4 %) were found at five or less localities. However, 18 species were found at twenty or more sites, and one species was found at 51 localities. When the distribution of species occurring at more than one site was examined, it was noted that they tended to be well distributed across the whole WCR region, rather than being clustered together. Table 3 provides a summary of average distances between populations of the same species, within eight classes, where a species occurred at two or more localities. The first item to note is that median distances between populations are similar to average distances, thus showing that the average distances, with the possible exception of the species occurring at two sites only, have not been distorted by one abnormally large or small distance. It should be noted that the populations of six of the 15 species with only two site records were separated by more than 20 km. The second point of interest is that there is no absolute pattern indicating that the more common species are, on average, more widely, or narrowly distributed than those species for which there are only two or three records. On the other hand, classes with more species do tend to have their most distant populations at a greater distance from each other, as one would expect when fitting more localities into a fixed area, while keeping average distance similar. Four hundred and seventy-four of 1 044 (45.4 %) locations recorded fell within fragments of > 3 ha identified by Newton & Knight (2005), whereas 380 (36.4 %) coincided with a fragment of > 25 ha. It has been suggested that fragments need to be 25 ha or larger in order to maintain a reasonable semblance of ecological integrity (Donaldson *et al.* 2002).

DISCUSSION

A number of objections can be raised about the validity of the results presented here. We will try to answer some of these below, but we believe that the queries raised, while important in themselves, do not nullify the object of our paper. The first query raised is the quality of the data. With the exception of Blouberg, and possibly the Tienie Versfeld Reserve, all the sites have been sampled by one or more competent botanist at an intensity that would be acceptable for the institution of management plans or a post graduate degree.

The second problem is that a number of the fragments sampled were not edaphically homogeneous and were adjacent to, or incorporated fynbos (e.g. Paarlberg, Elandsberg). Plant collections at these sites have been predominantly carried out in terms of the site, rather than the soil type upon which the species collected was found. While this will obviously create differences between the sites, the question we are asking here is, how many species does this site have in common with the other sites? If renosterveld has a high level of homogeneity, there should be a relatively large number of species that are common to all sites, irrespective of additional species from adjacent vegetation types. Table 2 shows that this is not the case. To demonstrate our basic premise we give two examples of sites of similar geology, situated close together. We will take the three closest (in space as well as in species composition) sites in the Darling area and the Tygerberg and Kanonkop sites in the Southwest area. The Darling sites are all classified as Cape Granite (Anon 1990) at the 1:250 000 scale, and as Swartland Granite Bulb Veld by Mucina & Rutherford (2004). Tygerberg and Kanonkop are both classified as Malmesbury Shale and Swartland Shale Renosterveld, by the same authors. The three sites at Darling shared 30.8 % of their species, and 41.5 % of the species were restricted to one site. The Tygerberg–Kanonkop situation is slightly different, as Kanonkop is much smaller

TABLE 3.—Mensural summary of distribution of rare and endangered species across West Coast Renosterveld

Average separation distance (km) per species, not per individual	No. localities at which species occurs, summarized in each column								Summary of all data (km)			
	2	3	4	5	6	7	8–19	20–51	All	Max.	Min.	Range
Average	18.5	24.8	23.2	34.0	36.9	21.5	35.4	39.0	29.2	39.0	18.5	20.5
sd average	23.27	20.08	15.45	13.94	17.48	11.19	12.6	9.04	15.38	23.3	9.0	14.2
Median	8.1	29.9	24.4	30.3	43.9	19.7	34.2	34.4	28.1	43.9	8.1	35.9
sd median		25.12	17.06	16.29	24.73	12.16	12.8	9.82	16.86	25.1	9.8	15.3
Max.	85.4	35.7	38.9	66.0	68.8	45.6	85.6	115.5	67.7	115.5	35.7	79.8
Min.	0.5	8.8	4.2	3.3	2.8	1.6	0.9	0.2	2.8	8.8	0.2	8.6
Range	84.9	26.9	34.7	62.7	66.0	43.9	84.7	115.3	64.9	115.3	26.9	88.4
N	15	51	17	11	16	9	40	18	177			

sd, standard deviation; N, no. species within each column category.

than the Tygerberg. Nevertheless, 65 species (12.1 % of the total found at the two sites) were restricted to Kanonkop. It is clear from these two examples that our results *are* distorted to a certain extent, by our inability to absolutely define those species that are confined to renosterveld soils. However, we believe that the two examples given, show that our basic premise, namely that there is a great deal of local endemism within WCR, is correct.

One might also raise the question of species that are compatible with both soil types. Should such species be considered in a study such as the one presented here? Local climatic conditions may also have an effect on species composition. For example, Boucher (1995) has suggested that the plant community on the Bottelary Hills, which consists of Malmesbury Shale and Cape Granite, would *revert* to fynbos under the right management regime.

Cluster analysis

The cluster diagrams themselves (Figure 2), while showing interesting patterns, do not necessarily give an indication of renosterveld homogeneity. This is because many of the sites are not edaphically homogenous and contain fynbos and thicket species. Differences between the sites might thus be construed as being caused by a variety of non-renosterveld species projected upon a basic renosterveld set of species. This problem has to a large extent been discussed above, and we would once again emphasize that our aim is to show there is not a large underlying set of species common to all sites. In the regional analysis (Figure 2A), four of the sites may be considered to have incorporated a large number of Fynbos species. Only the two regional sites and the Stellenbosch site might be considered to contain predominantly renosterveld species, yet the Stellenbosch site is the most unique site, in terms of species. This is interesting as only species recorded from the ‘grey-bush’ community of Duthie (1930) and the renosterveld site of Levyns (1929) were used, suggesting a minimal influence of fynbos and thicket species. This difference could be due to the higher rainfall that the area receives, compared to the other sites examined.

Looking at the mixed sites, where fynbos species may predominate in the species lists, about one-third of the species found at the Paarlberg and at Voelvlei–Elandsberg were not found at any of the other sites. The species list of Paarlberg does not differentiate between the lower slopes (considered to be renosterveld), and the higher regions, considered to be fynbos (Low & Rebelo 1996) or Fynbos/Renosterveld Mosaic (Cowling & Heijnis 2001). The mosaic of vegetation types (first author pers. obs.) at Elandsberg similarly meant that assigning a species to a specific vegetation (soil) type was not possible. Although Tansley’s (1982) Voelvlei species list (41 indigenous species) was included in the Voelvlei–Elandsberg site, (Voelvlei is geologically more likely to be renosterveld, Anon. 1997), only eight of the 741 species were restricted to Voelvlei. Two of the single-site samples (Eensaamheid [Jan Briers Louw] and Tienie Versfeld Reserve) have had their renosterveld connections disputed (Tansley 1982; Savory 1986).

The Southwest and Darling regions each have a number of sites within a relatively small area. There is a greater level of natural connectivity between the Darling hills than between those of the Southwest sites, which have largely been isolated by urbanization. Both of these regions have been well sampled.

In the Southwest region (Figure 2B) the low sampling intensity of Blouberg (51 species) leaves its associations with the other hills in doubt. Like the Klein Dassenberg, this hill supports renosterveld, thicket and fynbos species (Jarman 1986). The cluster analysis showed the Tygerberg and Kanonkop to be the most closely related sites. The relationship between these two sites was discussed earlier. Signal Hill and Tygerberg (the two largest sites) have been well sampled, suggesting that their high (one-third) levels of local endemism are probably genuine. However, one should note that the Tygerberg is entirely a shale formation, whereas Signal Hill comprises shales, granites and Table Mountain Sandstones (Anon. 1990). Both Meerendal and Hoogekraal showed quite high levels of local endemism despite relatively small (111 and 131 respectively) species lists. The high level of endemism at these two small sites is interesting because these hills are in an area that has been cultivated for three hundred or more years. It suggests that the species present are relatively immune to disturbance.

In the Darling region (Figure 2C), we might exclude the Tienie Versfeld Reserve, the Klein Dassenberg and the Dassenberg, as these three sites have a mixture of soils. The remaining seven hills still had 34.5 % of their species confined to one site, and as shown earlier, the closest sites do not always have the closest affinities.

Botanical Society lowlands project and CREW data

Plant lists made during the Renosterveld Lowlands Project were confined to the dominant and rare species (Von Hase *et al.* 2003). Therefore, the observation that only five of the species identified occurred at more than 20 of their sites is important. Despite the general assumption that coastal renosterveld is a vegetation type dominated by a few species, we find that the most common species (*Eriocephalus africanus*) only occurred at 72 (63.2 %) of the 114 sites. The sample sites were more widespread than was the case with the published data, and included small patches. Some of the larger fragments had been sampled at more than one spot, thus allowing one to get an idea of the within-fragment diversity. Taking nine such fragments, it was found that the number of species confined to only one sample site within the fragment ranged between 52.6 % and 87.5 % of the species recorded (Table 4). One needs to take into account that the sampling effort was low, but again, it does suggest that there is a very high level of beta or gamma diversity within WCR.

At first glance, the CREW rare and endangered species data appear to contradict the other analyses. Although by definition uncommon (and one thus assumes locally endemic), Table 3 showed that the populations were widely distributed across the entire WCR landscape. In some instances, even those species for which there were only two or three records were widely separated. Keeping in mind that the bounds of

TABLE 4.—No. species common to each subsample site within fragments that were sampled at two or more localities

Fragment	No. species records per fragment	No. unique species per fragment	No. unique species occurring in each subsample				
			In 1 subsample only	In 2 subsamples only	In 3 subsamples only	In 4 subsamples	% in 1 subsample only
Kapokberg	28	23	19	3	1	-	82.6
Swartberg	28	20	14	4	2	0	70.0
Elandsberg	22	14	8	4	2	-	57.1
Voelvlei	16	13	10	3	-	-	76.9
S Kasteelberg	24	21	18	3	-	-	85.7
N Kasteelberg	28	19	10	9	-	-	52.6
E Piketberg sth	27	24	21	3	0	-	87.5
E Piketberg nth	15	12	9	3	-	-	75.0
Saronberg	29	24	20	3	1	0	83.3

WCR approximates a diamond, 184 km (N–S) by 78 km (E–W), the average distance separating populations of these rare species was often substantial.

How can we explain the apparent contradiction between the CREW data and the other analyses? The subsample data of the lowlands project (Table 4) showed that even within a single large fragment, there was a high level of diversity. It is possible that the diversity of the habitat is much greater, as experienced by the plants, than is often perceived by humans. The establishment of species may also have been influenced by environmental and seasonal factors in existence at the time the fragment was burnt, cleared or otherwise disturbed, with an intensity sufficient to allow a change in community composition. Therefore, although from a gross overview the landscape is dominated by a few shrubs, within which are interspersed a variety of grasses and geophytes, there is great variation in how these are distributed, and micro-habitat and disturbance play a much greater role than is thought. Cowling & Lombard (2002) have suggested that plants of the Cape Floristic Region (CFR) respond to measures of heterogeneity that are more subtle than the coarse variables used in most studies. There may be generalist species, as well as local 'invasions' of species from adjoining fynbos and thicket communities, adding to the unique character of each site. It is likely that the rare and endangered species were, like most other 'true' WCR species, once more common than now, but still confined to particular niches. Due to fragmentation and a breakdown in ecological processes such as pollination, and the spread of seeds by large herbivores, they remain as isolated populations.

Conservation action

Cowling *et al.* (1992) showed that there were substantial increases in the number of species recorded as one increased the size of the samples site, within WCR and other CFR vegetation types. Our aim was not to test this, as to a general extent, this would be intuitive. Our aim was to show that there is a great deal of variation in community composition across WCR, and that conserving a few large fragments does not guarantee a high level of conservation of renosterveld endemic species. We have shown that, while there may be a limited number of species within WCR, and while those species may occur, not only at more than one site, but also at widely distributed sites, the vegetation is not homogeneous at the scale of the remaining fragments.

With the above facts in mind, what should be the next step for the conservation of WCR? We already have a great deal of data, and this is being augmented annually by student projects, professional conservation staff and volunteers guided by CREW. Grantham *et al.* (2008, 2009) have pointed out that there is a trade-off in conservation between data collection and time or money. We would suggest that more than enough basic data have been collected for WCR and the region would benefit from the application of a C-Plan or similar analysis. It will obviously not be possible to save everything *in situ*, but a priority list of the sites for conservation needs to be produced. This will also help the stewardship projects in showing the owners of smaller fragments with endangered species, the unique quality of their particular fragment.

Mucina & Rutherford (2004) have subdivided the original entity of WCR into six units, substantially reducing its presence in what was formerly considered to be one of the primary fragments, namely the Elandsberg Private Nature Reserve. Although this new division will help with the allocation of resources towards conserving examples of each vegetation type, we believe that in the case of WCR, consideration should also be paid to the local climate conditions. Rainfall in particular, increases steeply from the NW to SE (Schulze 1997) and this study has shown that, while the Darling Hills and the Paarlberg are both classified as Swartland Granite Bulb Veld, there is a great deal of difference between the two areas.

CONCLUSION

One might conclude that, rather than WCR being home to many *local* endemics, it is home to many widespread *micro-habitat* endemics. Rebelo's (1995) assumption is therefore basically correct, but could be misleading, as the remaining fragments each only contain a small proportion of the species. The implications of this for conservation is that small isolated patches may contain unique species, and the opinion of Von Hase *et al.* (2003), that small fragments are merely subpopulations of the remaining larger extents, is probably incorrect. The larger fragments need to be subsampled at a suitable time of year, to see to what extent the species distribution within each fragment is dependent upon such micro-habitats. If this hypothesis is valid, it is likely to lead to an even greater level of extinction due to climate change than might otherwise be assumed, since corridors proposed for movements across the landscape are likely to be missing many of these micro-habitats.

ACKNOWLEDGEMENTS

This material was based upon work supported by the National Research Foundation (NRF) of South Africa under Grant no. 2053674 awarded to Prof. Suzanne J. Milton. The first author acknowledges receipt of a bursary from the NRF. We would also like to thank Domitilla Raimondo for providing us with the CREW and other data from the Botanical Society, Mrs Elizabeth Parker for providing her personal checklist of the flora of the Elandsberg Private Nature Reserve, and Prof. Suzanne Milton for providing her amalgamated checklist of the flora of the Paarlberg. We also thank Richard Cowling and an anonymous referee for their comments.

REFERENCES

ANONYMOUS. 1990. *3318 Cape Town: 1:250 000 Geological Series.* Government Printer, Pretoria.

ANONYMOUS. 1997. *3319 Worcester: 1:250 000 Geological Series.* Council for Geoscience, Pretoria.

ARNOLD, T.H. & DE WET, B.C. (eds). 1993. Plants of southern Africa: names and distribution. *Memoirs of the Botanical Survey of South Africa* No. 62: 1–825.

BOND, P. & GOLDBLATT, P. 1984. Plants of the Cape Flora—a descriptive catalogue. *Journal of South African Botany*, Suppl. 13.

BOUCHER, C. 1995. Overview on management of Renosterveld. In A.B. Low & F.E. Jones, *The sustainable use and management of renosterveld remnants in the Cape Floristic Region* (*Proceedings of a Symposium*): 47–50. FCC Report 1995/4. Flora Conservation Committee, Botanical Society of South Africa, Kirstenbosch, Cape Town.

COWLING, R.M. & HEIJNIS, C.E. 2001. The identification of Broad Habitat Units as biodiversity entities for systematic conservation planning in the Cape Floristic Region. *South African Journal of Botany* 67: 15–38.

COWLING, R.M., HOLMES, P.M. & REBELO, A.G. 1992. Plant diversity and endemism. In R.M. Cowling, *The ecology of fynbos: nutrients, fire and diversity*: 62–112. Oxford University Press, Cape Town.

COWLING, R.M. & LOMBARD, A.T. 2002. Heterogeneity, speciation/extinction history and climate: explaining regional plant diversity patterns in the Cape Floristic Region. *Diversity & Distributions* 8: 163–179.

DONALDSON, J., NANNI, I., ZACHARIDES, C. & KEMPER, J. 2002. Effects of habitat fragmentation on pollinator diversity and plant reproductive success in Renosterveld shrublands of South Africa. *Conservation Biology* 16,5: 1267–1276.

DUTHIE, A.V. 1930. List of vascular cryptogams and flowering plants of the Stellenbosch Flats. *Annals of the University of Stellenbosch* 8, sec. A, no. 4: 5–54.

GERMISHUIZEN, G. & MEYER, N.L. (eds). 2003. Plants of southern Africa: an annotated checklist. *Strelitzia* 14. National Botanical Institute, Pretoria.

GIBBS RUSSELL, G.E., REID, C., VAN ROOY, J. & SMOOK, L. 1985. List of species of southern African plants, edn 2,1. *Memoirs of the Botanical Survey of South Africa* No. 51: 1–152.

GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L., BARKER, N.P., ANDERSON, H.M. & DALLWITZ, M.J. 1990. Grasses of southern Africa. *Memoirs of the Botanical Survey of South Africa* No. 58: 1–437.

GIBBS RUSSELL, G.E., WELMAN, W.G., RETIEF, E., IMMELMAN, K.L., GERMISHUIZEN, G., PIENAAR, B.J., VAN WYK, M. & NICHOLAS, A. 1987. List of species of southern African plants, edn 2,2. *Memoirs of the Botanical Survey of South Africa* No. 56: 1–270.

GOLDBLATT, P. & MANNING, J. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9. National Botanical Institute, Pretoria & Missouri Botanical Garden, St. Louis.

GRANTHAM, H.S., MOILANEN, A., WILSON, K.A., PRESSEY, R.L., REBELO, T.G. & POSSINGHAM, H.P. 2008. Diminishing return on investment for biodiversity data in conservation planning. *Conservation Letters* 1: 190–198.

GRANTHAM, H.S., WILSON, K.A., MOILANEN, A., REBELO, T.G. & POSSINGHAM, H.P. 2009. Delaying conservation actions for improved knowledge: how long should we wait? *Ecology Letters* 12: 293–301.

HARVEY, W.H. & SONDER, O.W. (eds). 1859–1860. *Flora capensis* 1. Reeve, London.

HARVEY, W.H. & SONDER, O.W. (eds). 1894a. *Flora capensis* 2. Reeve, London.

HARVEY, W.H. & SONDER, O.W. (eds). 1894b. *Flora capensis* 3. Reeve, London.

HEYDENRYCH, B.J. & LITTLEWORT, P.E. 1995. *Flora survey of Darling. A preliminary investigation into the conservation of renosterveld remnants in the Darling area.* FCC Report 95/3. Flora Conservation Committee, Botanical Society of South Africa, Kirstenbosch, Cape Town.

JARMAN, M.L 1986. *Conservation priorities in lowland regions of the Fynbos Biome.* South African National Scientific Programmes Report No. 87: 1–55.

JOUBERT, C & MOLL, E.J. 1992. A phytosociological study of Signal Hill, Cape Town, utilizing both perennial and ephemeral species. *Bothalia* 22: 255–282.

KEMPER, J., COWLING, R.M. & RICHARDSON, D.M. 1999. Fragmentation of South African renosterveld shrublands: effects on plant community structure and conservation implications. *Biological Conservation* 90: 103–111.

KILIAN, D. 1995. *Dreams for the Dassenberg: a report on the current status and future options for flora conservation in the Dassenberg–Mamre–Riverlands area.* FCC Report 95/2. Flora Conservation Committee, Botanical Society of South Africa, Kirstenbosch, Cape Town.

LEVYNS, M.R. 1929. Veld burning experiments at Idas Valley, Stellenbosch. *Transactions of the Royal Society of South Africa* 17: 61–92.

LOW, A.B. & REBELO, A.G. 1996. *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria.

MCDOWELL, C. 1995. Grazing and renosterveld management. In A.B. Low & F.E. Jones, *The sustainable use and management of renosterveld remnants in the Cape Floristic Region* (*Proceedings of a Symposium*): 63–80. FCC Report 1995/4. Flora Conservation Committee, Botanical Society of South Africa, Kirstenbosch, Cape Town.

MUCINA, L. & RUTHERFORD, M.C. (eds). 2004. *Vegetation map of South Africa, Lesotho and Swaziland: Shapefiles of basic mapping units. Beta version 3.0, January 2004.* National Botanical Institute, Cape Town.

NEWTON, I.P. & KNIGHT, R.S. 2005. The use of Landsat imagery for the identification of the remaining West Coast Renosterveld fragments, Western Cape Province, South Africa. *South African Journal of Botany* 71: 67–75.

REBELO, A.G. 1995. Renosterveld: conservation and research. In A.B. Low & F.E. Jones, *The sustainable use and management of renosterveld remnants in the Cape Floristic Region* (*Proceedings of a Symposium*): 32–42. FCC Report 1995/4. Flora Conservation Committee, Botanical Society of South Africa, Kirstenbosch, Cape Town.

REYERS, B., FAIRBANKS, D.H.K., VAN JAARSVELD, A.S. & THOMPSON, M.W. 2001. South African vegetation priority conservation areas—a coarse filter approach. *Diversity & Distributions* 7: 79–89.

ROMESBURG, H.C. 1984. *Cluster analysis for researchers.* Lifetime Learning Publications, Belmont, California.

ROUGET, M., RICHARDSON, D.M., COWLING, R.M., LLOYD, J.W. & LOMBARD, A.T. 2003. Current patterns of habitat transformation and future threats to biodiversity in terrestrial ecosystems of the Cape Floristic Region, South Africa. *Biological Conservation* 112: 63–85.

SAVORY, J. 1986. *The effects of overgrazing on the structural-functional composition of West Coast Renosterveld.* Unpublished third year project, Botany Department, University of Cape Town.

SCHULZE, R.E. 1997. *South African atlas of agrohydrology and climatology.* Water Research Commission, Pretoria, Report TT82/96.

TANSLEY, S. 1982. *Koppie Conservation Project.* Unpublished report for the South African Nature Foundation.

THISELTON-DYER, W.T. (ed.). 1896. *Flora capensis* 6. Reeve, London.

THISELTON-DYER, W.T. (ed.). 1897. *Flora capensis* 7. Reeve, London.

THISELTON-DYER, W.T. (ed.). 1904. *Flora capensis* 4,2. Reeve, London.

THISELTON-DYER, W.T. (ed.). 1909. *Flora capensis* 4,1. Reeve, London.

THISELTON-DYER, W.T. (ed.). 1912. *Flora capensis* 5,1. Reeve, London.

THISELTON-DYER, W.T. (ed.). 1913. *Flora capensis* 5,3. Reeve, London.

THISELTON-DYER, W.T. (ed.). 1925. *Flora capensis* 5,2. Reeve, London.

WOOD, J. & LOW, A.B. 1993. *Environmental survey and management guidelines for the Tygerberg and environs, Part 1.* Unpublished report, National Botanical Institute, Cape Town.

VON HASE, A., ROUGET, M., MAZE, K. & HELME, N. 2003. *A fine-scale conservation plan for Cape lowlands renosterveld: technical report (main report).* Report No. CCU 2/03, Cape Conservation Unit, Botanical Society of South Africa.

Bothalia 40,2: 227–232 (2010)

OBITUARY

MICHAEL JOHN WELLS (1935–2010)

I come from the land of the Zulus
Where the countrymen are dark
They shout their news from the hilltops
Twang their guitars and laugh!
And the laughter of the Zulu
Is a chuckling belly-laugh.

This is the first verse of *The Countryman's Salute*, one of his many poems which is chosen here to frame a picture of Michael John Wells (Figure 1)—botanist, artist, organizer, gardener, humanitarian.

But when he meets you and greets you
It's a serious affair
Where brother acknowledges brother
And measures his mind with care.
For the eye of the Zulu is darker
And his thoughts more simple and plain
Than the calm that promises peace,
—in the eye of a hurricane!

Michael John Wells was born in the capital of God's Own Country (Pietermaritzburg in what is now known as KwaZulu-Natal) on the 23rd of October 1935. His father was a teacher, later a lecturer at the Teacher's Training College in Pietermaritzburg. He kindled in Michael an interest in and a love for nature which was to guide him in the direction of biology. In 1952 he matriculated in his home town with Art and Technical Drawing as subjects. The following year he enrolled at the University of Natal for a B.Sc. course with Zoology and Botany as majors. At first he tended towards Zoology, in view of his interest in and knowledge of butterflies which had brought him in contact with the lepidopterist K.M. Pennington for whom he collected specimens. An article on a butterfly and its host plant (Wells 1958) and a review of *Pennington's butterflies* (Wells 1980) are visible results of this interest. Mike much later undertook a study of lepidoptera during a visit to Madagascar. Under the guidance of Prof. Adolf Bayer he moved in the direction of Botany and completed his B.Sc.(Hons) in 1956. During 1957–1958 he undertook an ecological survey of the Ngeni Valley on the topic: *An account of the plant ecology of the Nagle Dam area of Natal.*

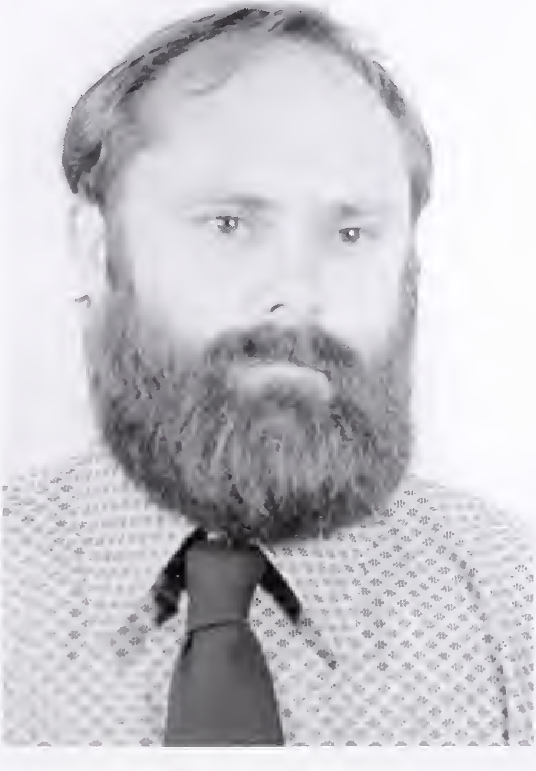


FIGURE 1.—Michael John Wells (1935–2010).

Michael applied for a post at the Botanical Research Institute on 28 October 1956 and assumed duty as Temporary Assistant Professional Officer at the University of Natal on 21 November 1956, pending permanent employment. His testimonials stressed 'power of concentration and the capability to work hard', as well as his 'ability to speak Afrikaans fluently enough to cope with conversation on assorted everyday topics as well as his work'. He was appointed to the Botanical Survey Section of the Institute in 1957 with the brief to complete his M.Sc. thesis and to write it up for publication. His mode of transport during field work periods was a privately owned motorbike (a BSA 4-stroke; mileage subsidized); his *in situ* accommodation: a tent, graduating to a shack 9' × 9' (3 × 3 m).

So it was that I learnt to greet him
In the veld as we passed by,
By slowly raising a hand in salute
To the level of my eye.
A silent, unspoken greeting
That says 'I see you there.'
No more, no less
—not 'friend' or 'stranger'
—not 'welcome' or 'go away'
But the hope of the world
In the sight of God,
I may need your help one day!

Michael was a perfectionist, and this could lead to non-fulfilment because he was loathe to publish until he was absolutely certain he could not make any further additions or improvements. Therefore he received his M.Sc. only in 1963 and the thesis was not formally published. Between 1960 and 1964 he undertook vegetation surveys requested by the Transvaal Provincial Administration. They covered the Loskop Dam Nature Reserve, the Abel Erasmus Pass area and the Jack Scott Nature Reserve and were published in the Administration's journal *Fauna & Flora* (Wells 1960, 1964; Wells & Strey 1961).

In 1961 he was transferred to the Institute's Research Unit at the Albany Museum in the City of Saints and Sinners, Grahamstown, where he was Officer in Charge until 1968. Not long after his transfer he advised his Head Office of an impending change of status, which came about on 30 September of that year when he married Estelle, née Rossouw, in Pretoria, a marriage destined to enrich this world by one son and two daughters: Michelle (1962), Stephen (1965) and Yvette (1967). His colleagues in Grahamstown included Estelle Brink who was also in the employ of the Institute; Amy Jacot Guillarmod, Senior Lecturer in Botany at Rhodes University; Prof. Stanley Seagrief, marine algologist at the same university; Hilary Deacon, archaeologist at the Albany Museum, later professor at Stellenbosch and his wife Janette; and Grace Britten, botanical assistant at the Albany Museum since 1922.

In his book *Human beginnings in South Africa*, published in 1999, Prof. Deacon writes: 'We were fortunate that the herbarium of the Botanical Research Institute was housed at the Albany Museum because it brought us into contact with the botanist Michael Wells. He was amazed to discover that some of the plant fragments from Scott's Cave (Wells 1965) were better preserved than the scientifically preserved specimens of much lesser antiquity in the herbarium. His meticulous identifications and analysis pioneered the study of archaeological plant remains'.

Michael often talked enthusiastically about the Hogsback and its forests, a mountainous region some 100 km northeast of Grahamstown, as the crow flies; the car will find it a lot farther. He and the family visited the area often, and his interest in the Hogsback and its people and industries can be well sensed in his article on the wagon-building industry (Figure 2) of the region (Wells 1973a).

When the impassioned, committed life of the indefatigable Amy Jacot Guillarmod had come to an end, Michael and Estelle Brink honoured her with a fitting farewell published in *Bothalia* 22 (Wells & Brink 1992).

In 1968 he was transferred to Pretoria and in 1969 took charge of the newly formed Economic Botany Section.

Now that I've left my homeland
And travelled—continents away
Where languages are different
And the people's eyes are grey
Clouded with suspicion
Indifferently staring away
I've found that the only greeting
That reaches to man the brute
Is the one that I've learnt from the Zulu
—the countryman's salute!

The new position enabled Mike to undertake an extensive tour of the USA and England. The tour report: *Economic Botany—aims, functions and priorities* (compiled in 1971), contains a wealth of information with special emphasis on new crop research. His work on economically important plants focused attention on problem plants, especially the introduced weeds. He made a major contribution to weed science in South Africa and in particular did much to create awareness of invasive plants. This led to a globe-encompassing study tour of *Nassella* (Figure 3), the invasive South American grass to which Mike drew wide attention with a forcefully conducted anti-publicity campaign.

Lesley Henderson, a leading figure in southern African weed research, relates that Mike introduced her to invasive alien plants (IAPs) and that it was his mentorship and inspiration that led to the development of roadside survey techniques for recording IAPs which ultimately culminated in the Southern African Plant Invaders Atlas (SAPIA) project. Michael was a founder member and a major driving force in the Southern African Weed Science Society (SAWSS) and served as its president for two terms: from 1988–1989 and 1993–1994.

He had the gift of the pen and used it to teach his staff how to write scientific papers. A draft paper would be returned to the author with numerous inserts, re-arrangements and corrections. In those days without computers,

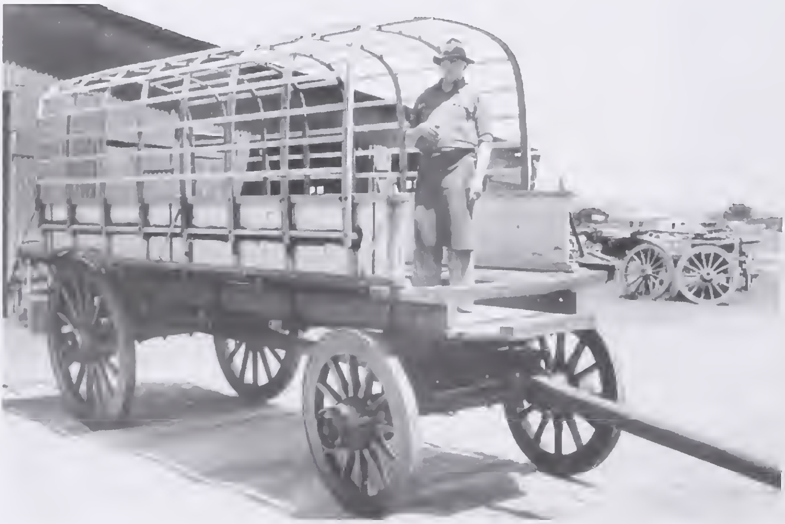


FIGURE 2.—An example of a wagon built at Keiskammahoek by Robert Ballantine & Co. which was active from 1928–1964.

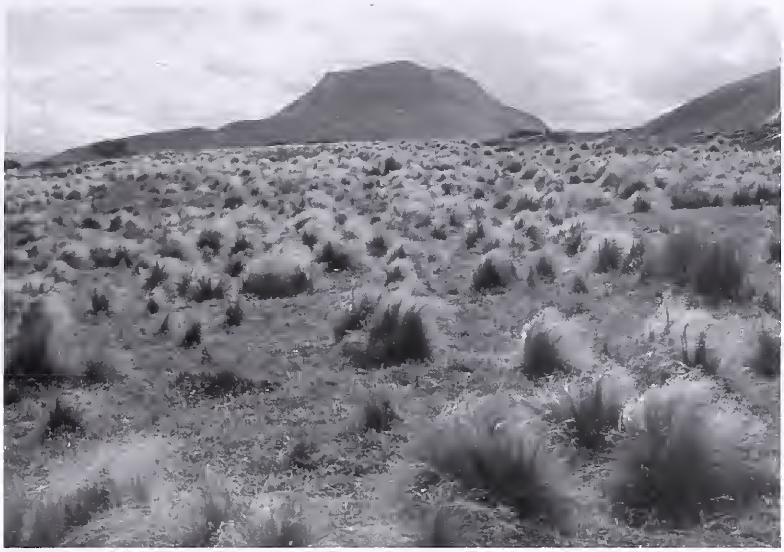


FIGURE 3.—Nassella tussock (*Nassella trichotoma*) invasion at Hogsback, Eastern Cape. Photograph: M.J. Wells, 1980.

it entailed cutting and pasting with scissors and glue. Mike was very particular about spelling, punctuation and correct grammar.

Creation was preceded by chaos: his office bulged with books, boxes and publications and had the atmosphere of a museum store room. When it had reached saturation point he took over another office that had been vacated. The overflow from this office landed up in one of the herbarium wings.

The weightiest (2.162 kg) of his publications is *A catalogue of problem plants in southern Africa* (Wells *et al.* 1986). His colleagues recall that proofreading of this book went on forever. It was laid out in one of the herbarium wings and all members of his staff took an hour or so a day to do a few pages. The co-authors of this book, all members of his staff, were A.A. (Aurelio) Balsinhas (Figure 4), H. (Pitte) Joffe, V.M. (Vicky) Engelbrecht, G. (Graham) Harding, & C.H. Stirton (Charlie, now Prof.). During the discussion at Head Office of a merit assessment that Mike had written about Charlie Stirton, the length of the list of publications and the level of praise assigned were such that some committee members were dumbfounded, others laughed admiringly, yet others were proposing a class 1++. Michael was later instrumental in re-appointing Denise Fourie to the Economic Botany Section, and in organizing a contract for Prof. emeritus Douw Steyn, to work on poisonous plants.

Michael was well known for his oral presentations and taught his staff to always be well prepared and rehearsed, to have good visual aids and to have a small torch handy in case it was needed. His talks always started and ended with a statement or photo with impact and there was always room for humour.

Several colleagues remember Mike's photographic sessions as highlights of the working calendar. These meetings were originally instituted for the benefit of members of his Economic Botany section but were eventually attended by members of several other sections because they were so enjoyable and instructive. Anybody could submit slides for viewing and constructive criticism. A well-known result of these sessions are the gardening books by Pitta Joffe. As one of Mike's staff members, she progressed in the field of plant photography from ignoramus to expert. Other people's meetings he often found deadly boring—the result: frame-worthy bedoodled minutes!

A look at Mike's collection of slides was a treat: plants of all descriptions and provenance richly interspersed with cartoons from all manner of publications. His sense of humour, which found audible expression in the form of Zulu-style chuckles rather than lusty laughter, found particularly verdant pastures in the adventures of Hägar the Horrible, as is well documented in the card that Estelle sent to family and friends after Michael's death (Figure 5).

Members of the Institute and their spouses who had small children at the time have fond memories of Michael in the role of Father Christmas, five years running. At the end of the fifth year a note appeared in an Institute newsletter under the heading:
A pleasantly mature executive retires:
Even in adult childhood, one does not expect Father Christmas to apply for early retirement. But at the end of 1992 this happened to us in Pretoria. Mike, we appreciate all you gave to the role, especially your willingness to arrive on tractors and motorbikes, ring bells and shoulder a bulging bag or two. Remember the day you even had to mind the rain, dear? Or was it reindeer? It was not an easy position to fill. In a recent recruiting advertisement the requirements were set out as follows: Applicants must be mature, well spoken, multilingual, very friendly, understanding and, ideally, have numerous grandchildren whom they will have learned to understand and also to communicate well with. In addition, they should, in view of the climate, carry a fair amount of extra weight, prefer their hair worn long and, ideally, again because of the climate, wear a healthy beard. Their maturity should be reflected in the silver whiteness of their hair. Applicants who have some knowledge of the dietary requirements of reindeer would be preferred,

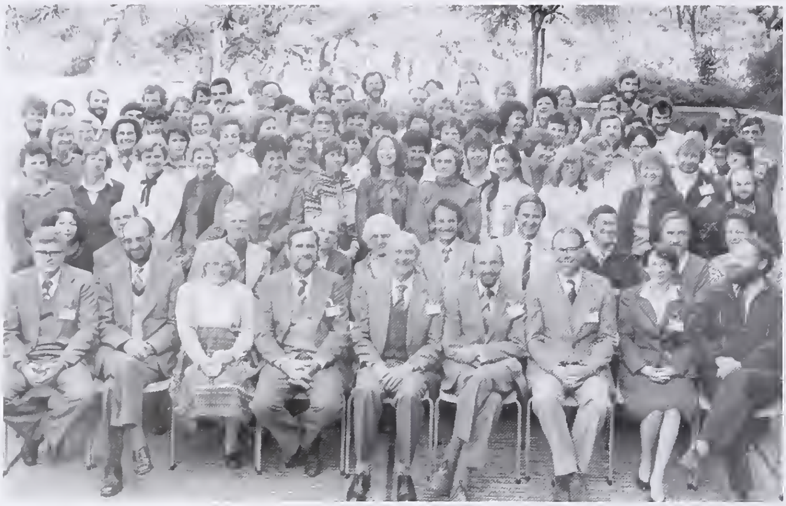
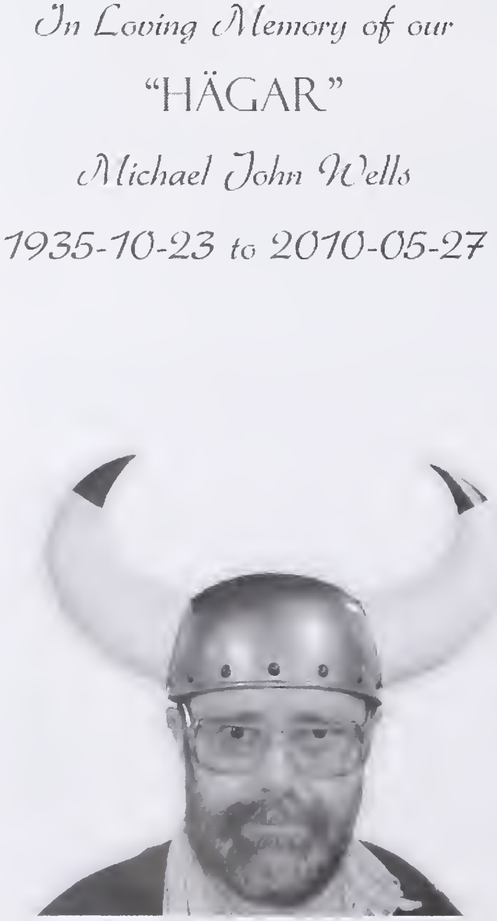


FIGURE 4.—General staff meeting of the Botanical Research Institute held at Pretoria in August 1983. Mike Wells is seated in the front row on the extreme right.

and a code 08 sleigh licence is essential. (Authors: Gill Condy & René Glen). Michael fitted these requirements, apart from the knowledge of reindeer fodder (or did he have that as well?) and the sleigh licence, almost to a T.



In Loving Memory of our

"HÄGAR"

Michael John Wells

1935-10-23 to 2010-05-27

FIGURE 5.—The card that Estelle sent to family and friends after Michael's death.

Michael was a great organizer. He was instrumental in planning, motivating for and implementing a massive fire security and air-condition system for the building. As far as I can remember his detailed and well-constructed motivation readily convinced the powers that be that the considerable funds required for such a scheme were wisely spent. He played a major role in organizing events such as the festivities surrounding the move to the new building in the Botanical Garden in Brummeria in 1973. For the occasion he published a brochure entitled *Under one roof/Onder een dak* (Wells 1973c). In 1978 the BRI celebrated its 75th anniversary, and here again Mike played an important part in the preparations for the occasion. Amongst others he gave a talk: 'The rôle of economic botany in the development of South Africa' (Wells 1979). Another aspect of Michael's involvement in this grand occasion can be illustrated by a picture of him chatting to the Minister of Agriculture, Hendrik Schoeman (Figure 6).

AETFAT (Association pour l'Étude Taxonomique de la Flore d'Afrique Tropical) held its first congress on the African continent in Pretoria in 1982. Dr Bernard de Winter, Director of the BRI at the time, was the current General Secretary of the Association, and the institute was responsible for many of the arrangements. The BRI offered a 'Meet and Greet' to the delegates during which Mike was one of the guides who took them through the garden.

Michael was as much a gardener as he was a botanist. He had a wide knowledge of garden plants, with a special love for gymnosperms, and he was involved in the management of the Pretoria Botanical Garden for years. He is well remembered for his involvement in the development of the 'Karoo Koppies', which are now situated between the boom entrance gate and the education centre. Michael directed the placement of large mounds of soil and boulders into their positions. These 'koppies' were later dubbed 'Mike's Mountains'.

In 1993, after 36 years with the BRI, later known as NBI (National Botanical Institute), Mike went into early retirement. One of the reasons for this decision was his health—he had problems with his back, as well as his

FIGURE 6.—Michael with the Minister of Agriculture, Hendrik Schoeman on the occasion of the 75th anniversary of the Botanical Research Institute (BRI) in 1978.

heart. Furthermore, the Institute was undergoing considerable changes at the time. But I think the main reason were the plans he had already made for his retirement: he was not only a good organizer but also a good planner. He was visualising a fine home surrounded by a splendid garden, overlooking the sea, somewhere in the southern Western Cape. In 1990 Mike and Estelle had made a tour along the south coast from Knysna westward to decide on a place for this home. In 1996 the vision materialized and Mike and Estelle, with their interest in architecture and interior decorating, designed and built the house of their dreams at Froggy Farm in Simonstown: sea view, garden, indoor swimming pool, fynbos surroundings and all. One of their neighbours was Hugh Taylor who had also worked for the BRI for many years. The Wellses had lived in Froggy Farm for eight years when they moved to 178 Heritage Manor, Heritage Park in Somerset West. They also had a hand in the design of this home which includes a sun room for the winter and a cosy, overcrowded study reigned over by creative chaos. Michael's heart condition had deteriorated over the years and he was fitted with several pacemakers. Shortly before his death he had a fall which further weakened his body, and on 27 May 2010, he passed away.

Michael could also cater for the inner man: he was a creative, improvising cook and a whisky connoisseur of considerable rating: witness a most comprehensive bottlery (= collection of bottles), lovingly amassed over the years and estimated to comprise some 100 specimens (mostly empty), all different brands.

I've used it on the pampas
—as I sipped my matte-tea
I've used it in the beech-hedged lanes
Of Devon's greenery.
I've touched my forelock in greeting
More times than I can tell
In New Zealand and Tahiti
—and in Peru, as well
And always they understood me
And knew that I wished them well!.

PUBLICATIONS AND REPORTS BY M.J. WELLS

HENDERSON, L. & WELLS, M.J. 1986. Alien plant invasions in the Grassland and Savanna Biomes. In I.A.W. Macdonald, F.J. Kruger & A.A. Ferrar, *The ecology and management of biological invasions in southern Africa*: 109–117. Oxford University Press, Cape Town.

HENDERSON, M., FOURIE, D.M.C., WELLS, M.J. & HENDERSON, L. 1987. *Declared weeds and invader plants in South Africa*. Bulletin 413, Department of Agriculture and Water Supply, Pretoria.

WELLS, M.J. 1958. *Thyronamys swinderianus variegatus* and *Acacia gerrardii. South African Biological Society Pamphlet* No. 20.

–1960. The climate and vegetation of the Loskop Dam Nature Reserve. *Fauna & Flora* 11: 21–36.

–1963. *An account of the plant ecology of the Nagle Dam area of Natal.* M.Sc. thesis. University of Natal, Pietermaritzburg.

–1964. The vegetation of the Jack Scott Nature Reserve. *Fauna & Flora* 15: 17–25.

–1965. An analysis of plant remains from Scott's Cave in the Gamtoos Valley. *South African Archaeological Bulletin* 78: 79–84.

–1968. *Medicago hirsuta* Gaertn. in the Eastern Cape. *Journal of the South African Biological Society* 7: 54–56.

–1970. Plant remains from Amanzi Springs. *Annals of the Cape Provincial Museums* (Natural History) 8: 191–194.

–1971 (unpublished). *A study tour of the USA: Economic Botany—aims, functions and priorities.* 87 pp.

–1973a. The effect of the wagon-building industry on the Amatola Forest. *Bothalia* 11: 153–157.

–1973b. Die belangrikheid van ekonomiese plantkunde vir die boer. In L. Lötter, *Boerderykeur* 27–29. Promedia Publishers, Johannesburg.

–1973c. *Under one roof/Onder een dak*—the story of the Botanical Research Institute. Brochure by the Department of Agricultural Technical Services, Pretoria. [Published after the move to the new building in Brummeria.]

–1974. Nassella trichotoma *(Nees) Hack. in South Africa*. Unpublished duplicated papers presented at the First National Weeds Conference 13, 14 August, 1974: 125–137. National Programme for Environmental Sciences, CSIR, Pretoria.

–1975. New threat to grazing. *Farmer's Weekly* July 30th: 12–16.

–1976a. *Nassella tussock threatens you*. Department of Agriculture Brochure.

–1976b. Vordering met en wenke oor die beheer van nassella-polgras in die oostelike Kaap Provinsie. In L. Lötter, *Boerderykeur*: 46–51. Kooperasiepers, Pretoria.

–1977. Progress with research on Nassella tussock. *Proceedings of the Second National Weeds Conference of South Africa*: 47–55.

–1978a. Nassella tussock. In C.H. Stirton, *Plant invaders: beautiful but dangerous*: 140–143. The Department of Nature and Environmental Conservation of the Cape Provincial Administration, Cape Town.

–1978b. What is a weed? *Environment RSA* 5, 11: 6.

–1979. The rôle of economic botany in the development of South Africa. *Bothalia* 12: 751–754.

–1980. Review: Pennington's butterflies of southern Africa, ed. C.G.C. Dickson with the collaboration of D.M. Kroon, 1978. *Bothalia* 13: 259, 260.

–1981a. Review: Flowering trees in subtropical gardens, by G. Kunkel, 1978. *Bothalia* 13: 590, 591.

–1981b. Review: Medicinal plants of West Africa, by E.S. Ayensu, 1978. *Bothalia* 13: 591.

–1983. Review: Medicinal plants of the West Indies, by E.S. Ayensu, 1982. *Bothalia* 14: 324.

–1984. Review: Medicinal plants and traditional medicine in Africa, by A. Sofowara, 1982. *Bothalia* 15: 343.

–1985. Review: Medicinal plants of North Africa, by L. Boulos, 1983. *Bothalia* 15: 778, 779.

–1989. Review: The Gardener's labyrinth, by T. Hill, 1988. *Bothalia* 19: 320.

–1991. Review: Kikuyu botanical dictionary of plant names and uses, by F.N. Gachathi, 1989. *Bothalia* 21: 115.

WELLS, M.J., BALSINHAS, A.A., JOFFE, H., ENGELBRECHT, V.M., HARDING, G. & STIRTON, C.H. 1986. A catalogue of problem plants in southern Africa. *Memoirs of the Botanical Survey of South Africa* No. 53.

WELLS, M.J. & BRINK, E. 1992. Obituary: Amy Frances Gordon Jacot Guillarmod, née Hean (1911–1992). *Bothalia* 22: 295–299.

WELLS, M.J., DUGGAN, K.J. & HENDERSON, L. 1980. Woody plant invaders of the central Transvaal. *Proceedings of the Third National Weeds Conference of South Africa, 1979*: 11–23. Balkema, Cape Town.

WELLS, M.J., ENGELBRECHT, V.M., BALSINHAS, A.A. & STIRTON, C.H. 1983a. Weed flora of South Africa 1: major groupings. *Bothalia* 14: 945–948.

–1983b. Weed flora of South Africa 2: power shifts in the veld. *Bothalia* 14: 961–965.

–1983c. Weed flora of South Africa 3: more power shifts in the veld. *Bothalia* 14: 967–970.

WELLS, M.J. & STREY, R.G. 1961. Plants of the Abel Erasmus Pass (ook verkrygbaar in Afrikaans). *Fauna & Flora* 12: 24.

O.A. LEISTNER*

---

* Formerly: South African National Biodiversity Institute, Private Bag X101, 0001 Pretoria. Present address: 194 Griselda Rd, Murrayfield, 0184 Pretoria.

Bothalia 40,2: 233–238 (2010)

South African National Biodiversity Institute: publications 1 January 2009 to 31 December 2009

Compiler: B.A. Momberg

ADAMS, T. 2009-02. *Pelargonium panduriforme* Eckl. & Zeyh. (Geraniaceae). Internet 2 pp.
http://www.plantzafrica.com/plantnop/pelargpanduri.htm.

ADAMS, T. 2009-04. *Pelargonium hispidum* (L.f.) Willd. (Geraniaceae). Internet 3 pp.
http://www.plantzafrica.com/plantnop/pelarghispidum%20.htm.

ADAMS, T. 2009-06. *Pelargonium laevigatum* (L.f.) Willd. (Geraniaceae). Internet 2 pp.
http://www.plantzafrica.com/plantnop/pelargoniumlaev.htm.

ADAMS, T. 2009-08. *Pelargonium quercifolium* (L.f) L'Hér. (Geraniaceae). Internet 3 pp.
http://www.plantzafrica.com/plantnop/pelargquer.htm.

ALBUQUERQUE, S., BRUMMITT, R.K. & FIGUEIREDO, E. 2009. Typification of names based on the Angolan collections of Friedrich Welwitsch. *Taxon* 58: 641–646.

ALTWEGG, R. & ANDERSON, M.D. 2009. Rainfall in arid zones: possible effects of climate change on the population ecology of blue cranes. *Functional Ecology* 23: 1014–1021. Digital object identifier (DOI): 10.1111/j.1365-2435.2009.01563.x.

ARENDSE, E. & NOTTEN, A. 2009-01. *Erica mammosa* L. (Ericaceae). Internet 2 pp.
http://www.plantzafrica.com/plantefg/ericamammosa.htm.

ARMSTRONG, A. 2009. *WET-Legal: wetland rehabilitation and the law in South Africa.* Water Research Commission (WRC) Report TT 338/09.

BARNARD, P. 2009a. Sustainable living: hypermiling. *Full Circle*, June 2009: 62.

BARNARD, P. 2009b. Sustainable living: climate change denialism—making sense of the myths about climate change. *Full Circle*, August 2009: 60–62.

BARNARD, P. 2009c. Sustainable living: fortress or community? *Full Circle*, September 2009: 62.

BARNARD, P. & SIMMONS, R. 2009a. Birds of the South: Elsie's Peak—birds on the edge. *Full Circle*, July 2009: 52.

BARNARD, P. & SIMMONS, R. 2009b. How will birds cope with climate change? *Africa Birds & Birding* 14,6: 78, 79.

BARNARD, P. & SIMMONS, R. 2009c. Rooi Els' jewels in the breeze—observers needed! *Rooi Els Breeze/Bries*, December: 3, 4. Newsletter of the Rooi Els Conservancy.

BARNARD, P. & SIMMONS, R. 2009d. The southern African Bird Atlas Project 2 (SABAP2). *Rooi Els Breeze/Bries*, December: 23. Newsletter of the Rooi Els Conservancy.

BERGH, N.G. & LINDER, H.P. 2009. Out of Africa: the Cape origins of the paper daisies (Asteraceae: Gnaphalieae) and trans-Indian Ocean disjunctions in southern hemisphere plant groups. *Molecular Phylogenetics and Evolution* 51: 5–18.

BESTER, S.P. 2009-11. *Mondia whitei* (Hook.f.) Skeels (Apocynaceae). Internet 6 pp.
http://www.plantzafrica.com/plantklm/mondiawhitei.htm.

BESTER, S.P. 2009-12. *Xysmalobium undulatum* (L.) Aiton f. var. *undulatum* (Apocynaceae). Internet 5 pp.
http://www.plantzafrica.com/plantwxyz/xysmalobundul.htm.

BESTER, S.P. & BEZUIDENHOUT, H. 2009. Poster: Wanted: pickled or pressed and definitely GPS'ed. *Proceedings of the Arid Zone Ecological Forum, Biodiversity conservation in arid zones: people, species and landscapes, Graaff-Reinet, Eastern Cape Province, 5–8 October 2009.*

BESTER, S.P. & CONDY, G. (Artist). 2009a. *Aspidoglossum ovalifolium* (Apocynaceae). *Flowering Plants of Africa* 61: 90–97.

BESTER, S.P. & CONDY, G. (Artist). 2009b. *Lavrania haagnerae.* (Apocynaceae). *Flowering Plants of Africa* 61: 98–106.

BLACKBURN, D.C. & MEASEY, G.J. 2009. Dispersal to or from an African biodiversity hotspot? *Molecular Ecology* 18: 1904–1915.

BLAUM, N., SEYMOUR, C.L., ROSMMANITH, E., SCHWAGER, M. & JELTSCH, F. 2009. Changes in arthropod diversity along a land use driven gradient of shrub cover in the southern Kalahari: identification of suitable indicators. *Biodiversity & Conservation* 18: 1187–1199.

BOATWRIGHT, J.S. & MANNING, J.C. 2009–08. *Trachyandra ciliata* (L.f.) Kunth (Asphodelaceae). Internet 3 pp.
http://www.plantzafrica.com/planttuv/trachyciliata.htm.

BOATWRIGHT, J.S., TILNEY, P.M. & VAN WYK, B-E. 2009. The generic concept of *Lebeckia* (Crotalarieae, Fabaceae): reinstatement of the genus *Calobota* and the new genus *Wiborgiella. South African Journal of Botany* 75: 546–556.

BOATWRIGHT, J.S. & VAN WYK, B-E. 2009. A revision of the African genus *Robynsiophyton* (Crotalarieae, Fabaceae). *South African Journal of Botany* 75: 367–370.

BRAND, L. & NOTTEN, A. 2009-09. *Erica sessiliflora* L.f. (Ericaceae). Internet 3 pp.
http://www.plantzafrica.com/plantefg/ericasessil.htm.

BREEN, C., DINI, J., MITCHELL, S. & UYS, M. (series eds). Wetland Management Series. Reports emanating from the project: Wetlands Research Programme: Wetland Rehabilitation (Water Research Commission Project No. K5/1408).

BUYS, M.H. 2009. *iKhambi-lamabulawo. Mesemb Study Group Bulletin* 24,4: 73–75.

BUYS, M.H. & NORDENSTAM, B. 2009a. De Candolle's *Prodromus*: the role of father and son in relation to names in *Lobostemon* (Boraginaceae) and typification thereof. *Candollea* 64: 289–293.

BUYS, M.H. & NORDENSTAM, B. 2009b. Nomenclature and typification of J.G.C. Lehmann and H. Buek names in *Lobostemon* (Boraginaceae). *Taxon* 58: 627–637.

CARLOS RUIZ, S., SINK, K.J., MCCLANAHAN, T.R. & COWAN, D.A. 2009-06. Bleaching response of corals and their *Symbiodinium* communities in southern Africa. *Marine Biology.* Digital object identifier (DOI): 10.1007/s00227-009-1236-8. 14 pp.

CHEEK, M. 2009. Pre-empting alien invasions in KwaZulu-Natal. *The Conservatory,* December: 16, 17.

CHEEK, M. 2009-09 *Dichrostachys cinerea* (L.) Wight & Arn. (Fabaceae) Internet 4 pp.
http://www.plantzafrica.com/plantcd/dichroscinerea.htm.

COOMBES, P.H., MWANGI, E.M., PETERS, B.K., CROUCH, N.R. & MULHOLLAND, D.A. 2009. The cyclobuta[b]quinoline alkaloid cyclomegistine from *Teclea gerrardii* I.Verd. (Toddalioideae: Rutaceae). *Biochemical Systematics and Ecology* 37: 494–496.

COWDEN, C. & KOTZE, D. 2009. *WET-RehabEvaluate: guidelines for monitoring and evaluating wetland rehabilitation projects.* Water Research Commission (WRC) Report TT 342/09.

COWELL, C. 2009-05. *Erica margaritacea* Sol. (Ericaceae). Internet 3 pp.
http://www.plantzafrica.com/plantefg/ericamarg.htm.

COWLING, R., LOGIE, C., SNIJMAN, D. & POTGIETER, G. 2009. A tale of two floras. *Veld & Flora* 95: 70–73.

CRAWFORD, R.J.M. & ALTWEGG, R. 2009. Seabirds and climate change in southern Africa: some considerations. In D.M. Harebottle, A.J.K. Craig, M.D. Anderson, H. Rakotomanana & M. Muchai, *Proceedings of the 12th Pan African Ornithological Congress, on 7–12 September 2008 at Goudini Spa, near Rawsonville, Western Cape*: 1–5. Animal Demography Unit, University of Cape Town.

CRAWFORD, R.J.M., UNDERHILL, G.L., ALTWEGG, R., DYER, B.M. & UPFOLD, L. 2009. Trends in numbers of kelp gulls *Larus dominicanus* off western South Africa, 1978–2007. *Ostrich* 80: 139–143.

CROUCH, N.R. & CONDY, G. (Artist). 2009. *Xerophyta longicaulis* (Velloziaceae). *Flowering Plants of Africa* 61: 42–49.

CROUCH, N.R., KLOPPER, R.R., SMITH, G.F. & CHILIZA, S. (Artist). 2009. *Aloe vossii* (Asphodelaceae). *Flowering Plants of Africa* 61: 8–16, t. 2242.

CROUCH, N.R., SMITH, G.F. & CONDY, G. (Artist). 2009. *Kalanchoe crenata* (Crassulaceae). *Flowering Plants of Africa* 61: 62–68.

CUI, Y.H., GUO, R. & GUO, D. 2009. A naïve five-element string algorithm. *Journal of Software* 4,9: 925–934.
http://academypublisher.com/.

CUPIDO, C.N. 2009. *Theilera robusta*, the correct name for *Theilera capensis* (Campanulaceae). *Bothalia* 39: 97, 98.

DANIEL, T.F. & FIGUEIREDO, E. 2009. The California Academy of Sciences Gulf of Guinea Expeditions (2001, 2006, 2008) VII.

Acanthaceae of São Tomé and Príncipe. *Proceedings of the California Academy of Sciences* 60: 623–674.

DE VILLIERS, M.S. 2009. *Birds and environmental change: building an early warning system in South Africa*. South African National Biodiversity Institute, Pretoria.

DEAN, W.R.J., BARNARD, P. & ANDERSON, M.J. 2009. When to stay, when to go: tradeoffs for arid zone birds in times of drought. *South African Journal of Science* 105: 24–28.

DO LINH SAN, E., MALONGWE, N.B., SOMERS, M.J. & WALTERS, M. 2009. A diverse diet without dominant prey: local and seasonal absence of highly profitable food resources for opportunistic black-backed jackals? *Wildlife Biology in Practice* 5: 96–103.

DONALDSON, J.S. 2009. Botanic garden science for conservation and global change. *Trends in Plant Science* 14: 608–613.

DUNCAN, G.D. 2009a. A striking new colour form of *Dietes bicolor*. *Bulletin of the Indigenous Bulb Association of South Africa* 57: 6, 7.

DUNCAN, G.D. 2009b. *Oxalis massoniana*. *Curtis's Botanical Magazine* 26: 86–95.

DUNCAN, G.D. 2009c. *Nerine humilis*. *Curtis's Botanical Magazine* 26: 200–209.

DUNCAN, G.D. 2009d. *Lachenalia congesta*. *Curtis's Botanical Magazine* 26: 210–220.

DUNCAN, G.D. 2009e. *Pseudogaltonia clavata*. *Bulbs* 10 & 11: 292–295.

DUNCAN, G. 2009-10. *Moraea tulbaghensis* L.Bolus (Iridaceae). Internet 3 pp.
http://www.plantzafrica.com/plantklm/moraeatul.htm.

DUNCAN, G.D., CRAIB, C.L. & CONDY, G. (Artist). 2009. *Nerine pancratioides* (Amaryllidaceae). *Flowering Plants of Africa* 61: 34–41.

DUNCAN, G.D. & VISAGIE, M. 2009. *Veltheimia bracteata* (Hyacinthaceae). *Flowering Plants of Africa* 61: 24–33.

ELLERY, W., GRENFELL, M., GRENFELL, S., KOTZE, D., MCCARTHY, T., TOOTH, S., GRUNDLING, P., BECKEDAHL, H., LE MAITRE, D. & RAMSAY, L. 2009. *WET-Origins: controls on the distribution and dynamics of wetlands in South Africa*. Water Research Commission (WRC) Report TT 334/09.

FADEN, R.B., LAYTON, D.J. & FIGUEIREDO, E. 2009. Three new species of *Commelina* L. (Commelinaceae) from south-central Africa. *Systematics and Geography of Plants* 79: 67–80.

FIGUEIREDO, E., GASCOIGNE, A. & ROUX, J.P. 2009. New records of pteridophytes from Annobón Island. *Bothalia* 39: 213–216.

FIGUEIREDO, E. & SMITH, G.F. 2009. The succulent flora of Angola. *Haseltonia* 15: 69–78.

FIGUEIREDO, E., SMITH, G.F. & CÉSAR, J. 2009. The flora of Angola: first record of diversity and endemism. *Taxon* 58: 233–236.

FIGUEIREDO, E., SOARES, M., SEIBERT, G., SMITH, G.F. & FADEN, R.B. 2009. The botany of the Cunene–Zambezi Expedition with notes on Hugo Baum (1867–1950). *Bothalia* 39: 185–211.

FORRESTER, J.A. 2009. *Harold Porter National Botanical Garden. A guide for visitors*. South African National Biodiversity Institute, Pretoria.

FORRESTER, J.A. 2009-05. *Laurophyllus capensis* Thunb. (Anacardiaceae). Internet 4 pp.
http://www.plantzafrica.com/plantklm/laurophylcap.htm.

FORRESTER, J.A. 2009-11. *Leucospermum conocarpodendron* (L.) H.Buek subsp. *viridum* Rourke (Proteaceae). Internet 6 pp.
http://www.plantzafrica.com/plantklm/leucoconovirid.htm.

FRONEMAN, W. 2009-02. *Barleria holubii* C.B.Clarke (Acanthaceae). Internet 2pp.
http:/www.plantzafrica.com/plantab/barleriaholubii.htm.

FRONEMAN, W. 2009-09. *Barleria scindens* Oberm. (Acanthaceae). Internet 2pp.
http:/www.plantzafrica.com/plantab/barleriascindens.htm.

GERMISHUIZEN, G., GROBLER, A. & CONDY, G. (Artist). 2009. *Pomaria sandersonii*. *Flowering Plants of Africa* 61: 58–62, t. 2229.

GLEN, H.F. 2009a. The Green Dragon—a virtual pub: there's food in them thar hills. *The Gardener* Jan.: 60.

GLEN, H.F. 2009b. The Green Dragon—a virtual pub: ...and those seeds? *The Gardener* Feb.: 60.

GLEN, H.F. 2009c. Tales from the Green Dragon—a virtual pub: aaah, caffeine! *The Gardener* Mar.: 62.

GLEN, H.F. 2009d. Tales from the Green Dragon—a virtual pub: the last braai of summer. *The Gardener* Apr.: 70.

GLEN, H.F. 2009e. Tales from the Green Dragon—a virtual pub: our very own royals. *The Gardener* May.: 70.

GLEN, H.F. 2009f. Tales from the Green Dragon—a virtual pub: so who were they? *The Gardener* Jun.: 62.

GLEN, H.F. 2009g. Tales from the Green Dragon—a virtual pub: come into the library, Maud. *The Gardener* Jul.: 62.

GLEN, H.F. 2009h. Tales from the Green Dragon—a virtual pub: I heard on the grapevine. *The Gardener* Aug.: 80.

GLEN, H.F. 2009i.Tales from the Green Dragon—a virtual pub: pickled trees? *The Gardener* Sep.: 86.

GLEN, H.F. 2009j. Tales from the Green Dragon—a virtual pub: is it an alien? *The Gardener* Oct.: 87.

GLEN, H.F. 2009k. Tales from the Green Dragon—a virtual pub: Nature's disaster management. *The Gardener* Nov.: 79.

GLEN, H.F. 2009l. Tales from the Green Dragon—a virtual pub: the Great Green Dragon Christmas Quiz. *The Gardener* Dec.: 71.

GLEN, H.F. 2009-08. *Strychnos cocculoides* Baker (Strychnaceae).
http://www.plantzafrica.com/plantoftheweek/plantweekmaxframwits.htm.

GOLDBLATT, P., BERNHARDT, P. & MANNING, J.C. 2009. Adaptive radiation of the putrid perianth: *Ferraria* (Iridaceae) and its unusual pollinators. *Plant Systematics and Evolution* 278: 53–65.

GOLDBLATT, P. & MANNING, J.C. 2009. New species of *Moraea* (Iridaceae: Iridoideae), with range extensions and miscellaneous notes for southern African species. *Bothalia* 39: 1–10.

GOLDBLATT, P., MANNING, J.C. & NÄNNI, I. 2009. New species of *Geissorhiza* (Iridaceae: Crocoideae) from the southern African winter rainfall zone, range extensions, taxonomic changes, and notes on pollen morphology and floral ecology. *Bothalia* 39: 123–152.

GRACE, O.M., SIMMONDS, M.S.J., SMITH. G.F. & VAN WYK, A.E. 2009a. Documented utility and biocultural value of *Aloe* L. (Asphodelaceae): a review. *Economic Botany* 63: 167–178.

GRACE, O.M., SIMMONDS, M.S.J., SMITH. G.F. & VAN WYK, A.E. 2009b. Taxonomic significance of leaf surface morphology in *Aloe* section *Pictae* (Xanthorrhoeaceae). *Botanical Journal of the Linnean Society* 160: 418–428.

GUGLIELMONE, L., GALLO, L., MEREGALLI, M., SMITH, G.F. & FIGUEIREDO, E. 2009. Allioni's *Aloe* names (Asphodelaceae): nomenclature and typification. *Bothalia* 39: 177–183.

GUO, D. & GUO, R. 2009. Simulating random fuzzy variable. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 848–852. Series of Information and Management Sciences, California Polytechnic State University, USA.

GUO, D., GUO, R. & CHENG, C.Y. 2009. Average chance distribution for random fuzzy variable with linear fuzzy location function with linear credibility distribution. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 842–847. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, D., GUO, R., CUI, Y.H. & THIART, C. 2009. Fuzzy regression under piecewise linear credibility distribution. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 690–694. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, R., FORREST, J. & GUO, D. 2009. DEAR linear dynamic quadratic control. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 626–632. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, R. & GUO, D. 2009a. Credibilistic fuzzy regression. *Reliability & Risk Analysis: Theory & Applications* 2,1,12: 74–85. Electronic Journal of International Group on Reliability, Gnedenko E-Forum.
http://gnedenko-forum.org/.

GUO, R. & GUO, D. 2009b. DEAR theory in system dynamic analysis. *Reliability & Risk Analysis: Theory & Applications* 2,2,13: 64–78. Electronic Journal of International Group on Reliability, Gnedenko E-Forum.
http://gnedenko-forum.org/.

GUO, R. & GUO, D. 2009c. Random fuzzy variable foundation for Grey differential equation modelling. *Soft Computing, Special issue on uncertainty analysis and decision making* 13,2: 185–201.

GUO, R. & GUO, D. 2009d. Regression motivated differential equation model. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna,* *China, July 20–28, 2009*: 856–862. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, R. & GUO, D. 2009e. Statistical estimation of credibility distribution. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 769–774. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, R. & GUO, D. 2009f. Statistical simulating fuzzy variable. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 775–778. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, R., GUO, D., DUNNE, T. & THIART, C. 2009. DEAR model—the theoretical foundation. *Journal of Uncertain Systems* 3,1: 36–51. ISSN online: 1752–8917.

GUO, R., GUO, D., & THIART, C. 2009. Poisson processes with fuzzy rate. *Reliability & Risk Analysis: Theory & Applications* 2,4:15: 115–1309. Electronic Journal of International Group on Reliability, Gnedenko E-Forum. http://gnedenko-forum.org/.

GUO, R., JIANG, T. & GUO, D. 2009. Random fuzzy risk processes. *Proceedings of the Eighth International Conference on Information and Management Sciences, Kunming & Banna, China, July 20–28, 2009*: 420–426. Series of Information & Management Sciences, California Polytechnic State University, USA.

GUO, R., JUWA, N., DUNNE, T. & GUO, D. 2009. Random fuzzy continuous-time Markov chains. In K. Kolowrocki, J. Soszynska & E. Zio, *Proceedings of Summer Safety and Reliability Seminars, Gsansk-Sopot, Poland, July 19–25, 2009*, vol. 1: 123–132.

GUO, R., JUWA, N. & GUO, D. 2009. Random fuzzy Poisson processes. In K. Kolowrocki, J. Soszynska & E. Zio, *Proceedings of Summer Safety and Reliability Seminars, Gsansk-Sopot, Poland, July 19–25, 2009*, vol. 1: 113–122.

HAMER, M. & SLOTOW, R. 2009. A comparison and conservation assessment of the high-altitude grassland and forest-millipede (Diplopoda) fauna of the South African Drakensberg. *Soil Organisms* 81: 701–717.

HAMER, M. & TAYLOR, P.J. 2009. Trends in zoological research in South Africa between 1980 and 2009. *African Zoology* 44: 232–240.

HARROWER, A. 2009-04. *Hermannia nana* (Eckl. & Zeyh.) Kuntze (Malvaceae). Internet 3 pp. http://www.plantzafrica.com/planthij/hermannianana.htm.

HARROWER, A. 2009-06. *Lachenalia orthopetala* Jacq. (Hyacinthaceae). Internet 3 pp. http://www.plantzafrica.com/plantklm/lachenorthopetala.htm.

HARROWER, A. 2009-10. *Hermannia grandiflora* Aiton (Sterculiaceae). Internet 2 pp. http://www.plantzafrica.com/planthij/hermanniagrand.htm.

HARROWER, A. 2009-12. *Oxalis purpurea* L. (Oxalidaceae). Internet 3 pp. http://www.plantzafrica.com/plantnop/oxalispurp.htm.

HERMAN, P.P.J. & RETIEF, E. 2009-09. *Rotheca louwalbertsii* (P.P.J.Herman) P.P.J.Herman & Retief (Lamiaceae). Internet 4 pages. http://www.plantzafrica.com/plantqrs/rothecalouw.htm.

HITCHCOCK, A. 2009-03. *Erica abietina* L. subsp. *atrorosea* E.G.H.Oliv. & I.M.Oliv. (Ericaceae). Internet 2 pp. http://www.plantzafrica.com/plantefg/ericaabiet_atrorosea.htm.

HITCHCOCK, A. 2009-06. *Erica abietina* L. subsp. *abietina* (Ericaceae). Internet 3 pp. http://www.plantzafrica.com/plantefg/ericaabietinasubab.htm.

HITCHCOCK, A. 2009-09a. *Erica abietina* subsp. *constantiana* E.G.H.Oliv. & I.M.Oliv. (Ericaceae). Internet 3 pp. http://www.plantzafrica.com/plantefg/ericaabientacon.htm.

HITCHCOCK, A. 2009-09b. *Erica formosa* Thunb. (Ericaceae). Internet 3 pp. http://www.plantzafrica.com/plantefg/ericaformosa.htm.

HITCHCOCK, A. 2009-10. *Syncarpha argyropsis* (DC.) B.Nord. (Asteraceae). Internet 3 pp. http://www.plantzafrica.com/plantqrs/syncarphaarg.htm.

HITCHCOCK, A. & NOTTEN, A. 2009-07. *Trichocladus grandiflorus* Oliv. (Hamamelidaceae). Internet 2 pp. http://www.plantzafrica.com/planttuv/trichocladusgrand.htm.

HOLLINGSWORTH, M., FORREST, L.L., SPOUGE, J.L., HAJIBABAEI, M., RATNASINGHAM, S., VAN DER BANK, M., CHASE, M.W., COWAN, R.S., ERICKSON, D.L., FAZEKAS, A.J., GRAHAM, S.W., JAMES, K.E., KIM, K.-J., KRESS, W.J., SCHNEIDER, H., VAN ALPHENSTAHL, J., BARRETT, S.C.H., VAN DEN BERG, C., BOGARIN, D., BURGESS, K.S., CAMERON, K.M., CARINE, M., CHACÓN, J., CLARK, A., CLARKSON, J.J., CONRAD, F., DEVEY, D.S., FORD, C.S., HEDDERSON, T.A.J., HOLLINGSWORTH, M.L., HUSBAND, B.C., KELLY, L.J., KESANAKURTI, P.R., KIM, J.S., KIM, Y-D., LAHAYE, R., LEE, H.-L., LONG, D.G., MADRIÑÁN, S., MAURIN, O., MEUSNIER, I., NEWMASTER, S.G., PARK, C.-W., PERCY, D.M., PETERSEN, G., RICHARDSON, J.E., SALAZAR, G.A., SAVOLAINEN,V., SEBERG, O., WILKINSON, M.J., YI, D.-K. & LITTLE, D.P. 2009. A DNA barcode for plants. *Proceedings of the National Academy of Science* 106: 12794–12797.

HOUNIET, D.T., THUILLER, W. & TOLLEY, K.A. 2009. Potential effects of predicted climate change on the endemic South African dwarf chameleon, *Bradypodion*. *African Journal of Herpetology* 58: 28–35.

HUI, C., VELDTMAN, R. & MCGEOCH, M.A. 2009. Measures, perceptions and scaling patterns of aggregated species distributions. *Ecography* 32: 1–8.

JAMES, B. 2009. Using GIS in biodiversity conservation across South Africa. *Position IT* Nov./Dec.: 43–45. Geo-information Society of South Africa (GISSA).

KLOPPER, R.R. 2009a. There is a new species of *Selaginella* in the Drakensberg. *Pteridoforum* 88: 1, 2.

KLOPPER, R.R. 2009b. Now you know! Giuseppe Raddi (1771–1829). *Pteridoforum* 88: 6.

KLOPPER, R.R. 2009c. Review: Synopsis of the Lycopodiophyta and Pteridophyta of Africa, Madagascar and neighbouring islands, by J.P. Roux, 2009. *Pteridoforum* 89: 1–3.

KLOPPER, R.R. 2009d. There is a new species of *Athyrium* in the Drakensberg. *Pteridoforum* 89: 4–6.

KLOPPER, R.R. 2009e. New genus and family concepts: Part 1. *Pteridoforum* 90: 1–5.

KLOPPER, R.R. 2009f. Now you know!: Klas Robert Elias Fries (1876–1966). *Pteridoforum* 90: 6.

KLOPPER, R.R. 2009g. New genus and family concepts: Part 2. A summary of changed taxon names. *Pteridoforum* 91: 1–5.

KLOPPER, R.R. 2009h. Now you know!: Wilhelm Gueinzius (1814–1874). *Pteridoforum* 91: 6.

KLOPPER, R.R., MATOS, S., FIGUEIREDO, E. & SMITH, G.F. 2009. *Aloe* in Angola (Asphodelaceae: Alooideae). *Bothalia* 39: 19–35.

KLOPPER, R.R., RETIEF, E. & SMITH, G.F. 2009. The genus *Aloe* L. (Asphodelaceae: Alooideae) in the Free State Province of South Africa. *Haseltonia* 15: 41–52.

KLOPPER, R.R. & SMITH, G.F. 2009a. *Aloe hahnii*, a new species in the section *Pictae*, in the Soutpansberg Centre of Endemism, Limpopo Province, South Africa (Asphodelaceae: Alooideae). *Bothalia* 39: 98–100.

KLOPPER, R.R. & SMITH, G.F. 2009b. Formalizing the synonymy of *Bulbine triebneri* (Asphodelaceae: Alooideae). *Bothalia* 39: 100, 101.

KONDLO, M. 2009-03. *Pycnostachys urticifolia* Hook. (Lamiaceae). Internet 4 pp. http://www.plantzafrica.com/plantnop/pycnourticifolia.htm.

KOTZE, D., BREEN, C., NXELE, I. & KAREKO, J. 2009. *WET-ManagementReview: the impact of natural resource management programmes on wetlands in South Africa*. Water Research Commission (WRC) Report TT 335/09.

KOTZE, D. & ELLERY, W. 2009. *WET-OutcomeEvaluate: an evaluation of the rehabilitation outcomes at six wetland sites in South Africa*. Water Research Commission (WRC) Report TT 343/09.

KOTZE, D., ELLERY, W., ROUNTREE, M., GRENFELL, M., MARNEWECK, G., NXELE, I., BREEN, C., DINI, J., BATCHELOR, A. & SIEBEN, E. 2009. *WET-RehabPlan: guidelines for planning wetland rehabilitation in South Africa*. Water Research Commission (WRC) Report TT 336/09.

KOTZE, D., MARNEWECK, G., BATCHELOR, A., LINDLEY, D. & COLLINS, N. 2009. *WET-EcoServices: a technique for rapidly assessing ecosystem services supplied by wetlands*. Water Research Commission (WRC) Report TT 339/09.

LALLA, R. 2009. The ant tree is a dangerous invader. *The Berea Mail*, 13 Nov.: 8. Durban.

LATIMER, A.M., SILANDER, J.A. & REBELO, A.G. 2009. Experimental biogeography: the role of environmental gradients in high geographic diversity in Cape Proteaceae. *Oecologia* 160: 151–162.

LAURENT, C., BAUDRY, J., BERRIET-SOLLIEC, M., KIRSCH, M., PERRAUD, D., TINEL, B., TROUVE, A., ALLSOPP, N., BON-

NAFOUS, P., BUREL, F., CARBEURI, M.J., GIRAUD, C., LABARTHE, P., MATOSE, F. & RUCRICG, A. 2009. Pourquoi s'interesser a la notion d' "evidence-based policy". *Revue Tiers Monde* 200: 853–873.

LOADER, S.P., MEASEY, G.J., DE SA, R. & MALONZA, P.K.. A new species of *Callulina* (Brevicipitidae) from the Taita Hills, Kenya. *Zootaxa* 2123: 55–68.

LOVELL, S., HAMER, M.L., SLOTOW, R. & HERBERT, D. 2009. An assessment of the use of volunteers for terrestrial invertebrate biodiversity surveys. *Biodiversity and Conservation* 18: 3295–3307.

LUCAS, N. 2009-01. *Aptenia cordifolia* (L.f.) Schwantes (Mesembryanthemaceae). Internet 2 pp. http://www.plantzafrica.com/plantab/apteniacord.htm.

LUCAS, N. 2009-07. *Felicia erigeroides* DC. (Asteraceae). Internet 2 pp. http://www.plantzafrica.com/plantefg/feliciaerigeroid.htm.

MACFARLANE, D., KOTZE, D., ELLERY, W., WALTERS, D., KOOPMAN, V., GOODMAN, P. & GOGE, M. 2009. *WET-Health: a technique for rapidly assessing wetland health*. Water Research Commission (WRC) Report TT 340/09.

MAGEE, A.R., VAN WYK, B-E. & TILNEY, P.M. 2009. A taxonomic revision of the woody South African genus *Notobubon* (Apiaceae: Apioideae). *Systematic Botany* 34: 220–242.

MAGEE, A.R., VAN WYK, B-E., TILNEY, P.M. & DOWNIE, S.R. 2009a. A taxonomic revision of *Capnophyllum* (Apiaceae: Apioideae). *South African Journal of Botany* 75: 283–291.

MAGEE, A.R., VAN WYK, B-E., TILNEY, P.M. & DOWNIE, S.R. 2009b. Generic delimitations and relationships of the Cape genera *Capnophyllum, Dasispermum* and *Sonderina,* the North African *Krubera* and *Stoibrax*, and a new monotypic genus of the subfamily *Apioideae* (Apiaceae). *Systematic Botany* 34: 580–594.

MAGEE, A.R., VAN WYK, B-E., TILNEY, P.M., SALES, F., HEDGE, I. & DOWNIE, S.R. 2009. *Billburttia*, a new genus of Apiaceae (tribe Apieae) endemic to Madagascar. *Plant Systematics and Evolution* 283: 237–245.

MALAN, H.L., APPLETON, C.C., DAY, J.A. & DINI, J.A. 2009. Wetlands and invertebrate disease hosts: are we asking for trouble? *Water SA* 35: 753–767.

MANNING, J.C. 2009a. *Field guide to South African wild flowers*. Struik, Cape Town.

MANNING, J.C. 2009b. Nomenclatural corrections in Ornithogaloideae. *Bothalia* 39: 221, 222.

MANNING, J.C., FOREST, F., DEVEY, D.S., FAY, M.F. & GOLDBLATT, P. 2009. A molecular phylogeny and a revised classification of Ornithogaloideae (Hyacinthaceae) based on an analysis of four plastid DNA regions. *Taxon* 58: 77–107.

MANNING, J.C. & GOLDBLATT, P. 2009a. Three new species of *Gladiolus* (Iridaceae) from South Africa, a major range extension for *G. rubellus* and taxonomic notes for the genus in southern and tropical Africa. *Bothalia* 39: 37–45.

MANNING, J.C. & GOLDBLATT, P. 2009b. *Albuca crispa* and *A. grandis* (Hyacinthaceae: Ornithogaloideae), two new species of subgenus *Albuca*, the rediscovery of *A. albucoides* (subgenus *Osmyne*), and the identity of *A. reflexa*. *Bothalia* 39: 153–163.

MANNING, J.C., GOLDBLATT, P. & FOREST, F. 2009. A revision of Fumariaceae (Fumarioideae) in southern Africa, including naturalized taxa. *Bothalia* 39: 47–65.

MANNING, J.C., GOLDBLATT, P. & HOOT, S.B. 2009. The genus *Knowltonia* subsumed within *Anemone* (Ranunculaceae). *Bothalia* 39: 217–219.

MANNING, J.C., GOLDBLATT, P. & WILLIAMSON, G. 2009. *Pseudogaltonia liliiflora* (Hyacinthaceae: Ornithogaloideae), a new species from the Richtersveld, Northern Cape. *Bothalia* 39: 229–231.

MANNING, J.C. & OLIVER, E.G.H. 2009. *Drimia oliverorum* (Hyacinthaceae: Urgineoideae), a new species from southern Namibia. *Bothalia* 39: 225–227.

MANNING, J.C., STYLES, D.G.A. & CROUCH, N.R. 2009. A new subspecies of *Pseudoprospero firmifolium* (Hyacinthaceae: Hyacinthoideae) from KwaZulu-Natal. *Bothalia* 39: 231–233.

MASHAU, A.C. 2009-04. *Hyparrhenia hirta* (L.) Stapf (Poaceae). Internet 3pp. http://www.plantzafrica.com/planthij/hyparrhirta.htm.

MCLELLAN, T., CROUCH, N.R. & CONDY, G. (Artist). 2009. *Begonia homonyma* (Begoniaceae). *Flowering Plants of Africa* 61: 76–82.

MCQUILLAN, M. 2009-01. *Salvia disermas* L. (Lamiaceae). Internet 2 pp. http://www.plantzafrica.com/plantqrs/salviadisermas.htm.

MCQUILLAN, M. 2009-10. *Diascia vigilis* Hilliard & B.L.Burtt (Scrophulariaceae). Internet 3 pp. http://www.plantzafrica.com/plantcd/diasciavigilis.htm.

MCQUILLAN, M. & LUCAS, N. 2009-11. *Dymondia margaretae* Compton (Asteraceae). Internet 2 pp. http://www.plantzafrica.com/plantcd/dymondiamarg.htm.

MCQUILLAN, M. & NOTTEN, A. 2009-09. *Protea lanceolata* E.Mey. ex Meisn. (Proteaceae). Internet 3 pp. http://www.plantzafrica.com/plantnop/protealanc.htm.

MEASEY, G.J., ARMSTRONG, A.J. & HANEKOM, C. 2009. Subterranean herpetofauna show a decline after 34 years in Ndumu Game Reserve, South Africa. *Oryx* 43: 284–287.

MEASEY, G.J., HOPKINS, K. & TOLLEY, K.A. 2009. Morphology, ornaments and performance in the Cape dwarf chameleon: is the casque bigger than the bite? *Zoology* 112: 217–226.

MEASEY, G.J., MALONZA, P.K. & MUCHAI, V. 2009. Amphibians of the Taita Hills. *SANBI Biodiversity Series* 12.

MENEGON, M., TOLLEY, K.A., JONES, T., ROVERO, F., MARSHALL, A.R. & TILBURY, C.R. 2009. A new species of chameleon (Sauria: Chamaeleonidae: *Kinyongia*) from the Magombera Forest and the Udzungwa Mountains National Park, Tanzania. *African Journal of Herpetology* 58,2: 59–70.

MIDGLEY, G.F., ALTWEGG, R., GUO, D. & MEROW, C. 2009. *Are quiver trees a sentinel for climate change in arid southern Africa?* South African National Biodiversity Institute, Cape Town.

MILLS, A., FEY, M., DONALDSON, J.S., TODD, S. & THERON, L. 2009. Soil infiltrability as a driver of plant cover and species richness in the semi-arid Karoo, South Africa. *Plant Soil* 320: 321–332.

MNAXTI, S. 2009-12. *Philenoptera violecea* (Klotzsch) Schrire. (Fabaceae). http://www.plantzafrica.com/plantoftheweek/plantweekmaxframwits.htm.

MOHAMMED, A.M.A., COOMBES, P.H., CROUCH, N.R. & MULHOLLAND, D.A. 2009. Non-volatile isolates of two *Heteropyxis* species: a first chemotaxonomic assessment of subfamily Psiloxyloideae (Myrtaceae). *Biochemical Systematics and Ecology* 37: 241–243.

MOMBERG, B.A. 2009. Compiler. South African National Biodiversity Institute: publications 1 January 2008–31 December 2008. *Bothalia* 39: 241–245.

MORT, M., RANDLE, C.P., BURGOYNE, P.M., SMITH, G.F., VAN JAARSVELD, E.J. & HOPPER, S.D. 2009. Analyses of cpDNA mat*K* sequence data place *Tillaea* (Crassulaceae) within *Crassula*. *Plant Systematics and Evolution* 283: 211–217.

MUSIL, C.F., ARNOLDS, J.L., VAN HEERDEN, P.D.R. & KGOPE, B. 2009. Mechanisms of photosynthetic and growth inhibition of a southern African geophyte by an invasive European annual grass. *Environmental and Experimental Botany* 66: 38–45.

MUSIL, C.F., VAN HEERDEN, P.D.R., CILLIERS, C.D. & SCHMIEDEL, U. 2009. Mild experimental climate warming induces metabolic impairment and massive mortalities in southern African quartz field succulents *Environmental and Experimental Botany* 66: 79–87.

MWABVU, T., HAMER, M. & SLOTOW, R. 2009. A new species of *Bicoxidens* Attems, 1928 (Diplopoda, Spirostreptida, Spirostreptidae) from northern Zimbabwe. *ZooKeys* 7: 75–81.

MWABVU, T., HAMER, M., SLOTOW, R. & BARRACLOUGH, D. 2009. A review of the taxonomy and distribution of *Plagiotaphrus* Attems 1914 (Diplopoda, Spirostreptida, Spirostreptidae). *Zootaxa* 2304: 51–60.

MWABVU, T., HAMER, M., SLOTOW, R. & BARRACLOUGH, D. 2009. A revision of the taxonomy and distribution of *Spirostreptus* Brandt 1833 (Diplopoda, Spirostreptida, Spirostreptidae) with descriptions of a new species and a new genus of spirostreptid millipede. *Zootaxa* 2211: 36–56.

NGWAVA, J.M., MALONZA, P.K. & MEASEY, G.J. 2009. Observations on the breeding behaviour of the Taita dwarf toad *Mertensophryne taitana* on Mt Mbololo, Taita Hills, Kenya. *African Journal of Herpetology* 58,1: 44–49.

NORDENSTAM, B. & BUYS, M.H. 2009. Proposal to conserve the name *Echium laevigatum* (*Lobostemon laevigatus*) (Boraginaceae) with a conserved type. *Taxon* 58: 303–305.

NOTTEN, A. 2009. Shelter from the sun, Create a shady refuge in your garden with a selection of small trees and shade plants from the Kirstenbosch Garden Fair. *Veld & Flora* 95: 26–29.

NOTTEN, A. 2009-03a. *Euryops annae* E.Phillips (Asteraceae). Internet 2 pp. http://www.plantzafrica.com/plantefg/euryopsannae.htm.

NOTTEN, A. 2009-03b. *Euryops tysonii* E.Phillips (Asteraceae). Internet 2 pp.
http://www.plantzafrica.com/plantefg/euryopstysonii.htm.

NOTTEN, A. 2009-06. *Protea laurifolia* Thunb. (Proteaceae). Internet 4 pp.
http://www.plantzafrica.com/plantnop/protealauri.htm.

NOTTEN, A. 2009-07. *Protea obtusifolia* H.Buek ex Meisn. (Proteaceae). Internet 3 pp.
http://www.plantzafrica.com/plantnop/proteaobtusifolia.htm.

NOTTEN, A. 2009-08. *Protea eximia* (Salisb. ex Knight) Fourc. (Proteaceae). Internet 3 pp.
http://www.plantzafrica.com/plantnop/proteaeximia.htm.

NOTTEN, A. 2009-12a. *Leucadendron loeriense* I.Williams (Proteaceae). Internet 4 pp.
http://www.plantzafrica.com/plantklm/leucaloerinse.htm.

NOTTEN, A. 2009-12b. *Leucospermum formosum* (Andrews) Sweet (Proteaceae). Internet 3 pp.
http://www.plantzafrica.com/plantklm/leucoformosum.htm.

NOTTEN, A. & JANUARY, E. 2009-01. *Leucospermum conocarpodendron* (L.) H.Buek subsp. *conocarpodendron* (Proteaceae). Internet 4 pp.
http://www.plantzafrica.com/plantklm/leucospermcono.htm.

NURRISH, L. 2009-03. *Thamnochortus lucens* (Poir.) H.P.Linder (Restionaceae). Internet 2 pp.
http://www.plantzafrica.com/planttuv/thamnolucens.htm.

NURRISH, L. 2009-06. *Platycaulos callistachyus* (Kunth) H.P.Linder (Restionaceae). Internet 4 pp.
http://www.plantzafrica.com/plantnop/platycaulcall.htm.

NURRISH, L. 2009-08. *Protea aurea* (Burm.f.) Rourke subsp. *potbergensis* Rourke (Proteaceae). Internet 3 pp.
http://www.plantzafrica.com/plantnop/proteaaureapot.htm.

NURRISH, L. 2009-11. *Leucospermum praecox* Rourke (Proteaceae). Internet 4 pp.
http://www.plantzafrica.com/plantklm/leucopraecox.htm.

O'FARRELL, P.J., DONALDSON, J.S. & HOFFMAN, M.T. 2009a. Local benefits of retaining natural vegetation for soil retention and hydrological services. *South African Journal of Botany* 75: 573–583.

O'FARRELL, P.J., DONALDSON, J.S. & HOFFMAN, M.T. 2009b. Small mammal diversity and density on the Bokkeveld escarpment, South Africa—implications for conservation and livestock predation. *African Zoology* 43: 117–224.

PARKER-ALLIE, F., MUSIL, C.F. & THUILLER, W. 2009. Effects of climate warming on the distributions of invasive Eurasian annual grasses—a southern African perspective. *Climatic Change* 94: 87–103.

PROCHEŞ, Ş., FOREST, F., VELDTMAN, R., CHOWN, S.L., COWLING, R.M., JOHNSON, S.D., RICHARDSON, D.M. & SAVOLAINEN, V. 2009. Dissecting the plant-insect diversity relationship in the Cape. *Molecular Phylogenetics and Evolution* 51: 94–99.

RAHLAO, S.J., MILTON, S.J., ESLER, K.J., VAN WILGEN, B. & BARNARD, P. 2009. Effects of invasion of fire-free arid shrublands by a fire-promoting invasive alien grass (*Pennisetum setaceum)* in South Africa. *Austral Ecology* 34: 920–928.

RETIEF, E. & BESTER, S.P. 2009-06. *Pelargonium crassicaule* L'Hér. (Geraniaceae). Internet 4 pp.
http:/www.plantzafrica.com/plantnop/pachycarpschinz.htm.

ROUNTREE, M., THOMPSON, T., KOTZE, D., BATCHELOR, A. & MARNEWECK, G. 2009. *WET-Prioritise: guidelines for prioritising wetlands at national, regional and local scales*. Water Research Commission (WRC) Report TT 337/09.

ROUX, J.P. 2009a. Anemiaceae, Aspleniaceae, Azollaceaea, Cyatheaceae, Davalliaceae, Dennstaedtiaceae, Dryopteridaceae, Hypolepidaceae, Isoetaceae, Lomariopsidaceae, Marsileaceae, Nephrolepidaceae, Oleandraceae, Ophioglossaceae, Parkeriaceae, Selaginellaceae, Tectariaceae. In I. Hedberg, Ib Friis & E. Persson, *Flora of Ethiopia and Eritrea*, vol. 1: Lycopodiaceae to Pinaceae. Addis Ababa, Ethiopia & Uppsala, Sweden.

ROUX, J.P. 2009b. Otto Kuntze's lycopods and fern collections from South Africa. *Bothalia* 39: 227–229.

ROUX, J.P., HOPPER, S.D. & SMITH, R.J. 2009. *Isoetes eludens* (Isoetaceae), a new endemic species from the Kamiesberg, Northern Cape, South Africa. *Kew Bulletin* 64: 123–128.

RUTHERFORD, M.C. & POWRIE, L.W. 2009a. Severely degraded dunes of the southern Kalahari: local extinction, persistence and natural re-establishment of plants. *African Journal of Ecology.* Pdf published online: 2-12-2009, 8:59 p.m. Digital object identifier (DOI): 10.1111/j.1365-2028.2009.01194.x.

RUTHERFORD, M.C. & POWRIE, L.W. 2009b. Severely degraded rangeland: implications for plant diversity from a case study in Succulent Karoo, South Africa. *Journal of Arid Environment* 74: 692–701.

SEYMOUR, C.L. 2009. Protégé *Ziziphus mucronata* (Rhamnaceae) show no negative effects of competition with the nurse tree *Acacia* (Leguminaceae), even as adults. *Journal of Vegetation Science* 20: 926–934.

SEYMOUR, C.L. & DESMET, P.G. 2009. Coping with drought—do science and policy agree. *African Journal of Science* 105: 18, 19.

SIRAMI, C., SEYMOUR, C.L., MIDGLEY, G. & BARNARD, P. 2009. The impact of shrub encroachment on savanna bird diversity from local to regional scale. *Diversity and Distributions* 15: 948–957.

SMITH, G.F. 2009a. Abstract: Systematics research in the South African National Biodiversity Institute. Bridging continents: new initiatives and perspectives in Natural History Collections. *Proceedings of the Annual Meeting of the Society for the Preservation of Natural History Collections* 24: 71. University of Leiden, Leiden, the Netherlands.

SMITH, G.F. 2009b. Documenting diversity at a global scale. Progress with the Species Plantarum Programme, Flora of the World. In P. Hiepko, Opiliaceae. *Species Plantarum: Flora of the World* 12: ix. Conservatoire et Jardin botaniques de la Ville de Genève, Chambésy.

SMITH, G.F. 2009c. *Kaktuszok és pozsgások*. Hajja & Fiai Könyvkiadó Kft., Debrecen.

SMITH, G.F. & CROUCH, N.R. 2009. *Guide to succulents of southern Africa*. Struik, Cape Town.

SMITH, G.F. & FIGUEIREDO, E. 2009a. *Aloe arborescens* Mill. (Asphodelaceae) is spreading in Portugal. *Bradleya* 27: 165–167.

SMITH, G.F. & FIGUEIREDO, E. 2009b. Capacity building in taxonomy and systematics. *Taxon* 58: 697–699.

SMITH, G.F. & FIGUEIREDO, E. 2009c. E-taxonomy: an affordable tool to fill the biodiversity knowledge gap. *Biodiversity and Conservation* 19: 829–836.

SMITH, G.F., FIGUEIREDO, E., CROUCH, N.R. & CONDY, G. (Artist). 2009. *Aloe pronkii* (Asphodelaceae). *Flowering Plants of Africa* 61: 1–6.

SMITH, G.F., FIGUEIREDO, E., PENNINGTON, T., DAVILA, P. 2009. Getting that grant: how to convince an evaluation panel that your proposal is worthy of funding. *Taxon* 58: 675–677.

SMITH, G.F. & SLAYTER, C. 2009. EDIT reaching out to southern counterparts: perspectives from the ABRS and SANBI. *EDIT Newsletter* 18: 7, 8.

SNIJMAN, D.A. & HARROWER, A.D. 2009. A new species of *Drimia* (Urgineoideae) from the Knersvlakte, Western Cape, South Africa. *Bothlalia* 39: 81–85.

STEYN, H.M. 2009. 2009-04. *Lachenalia framesii* W.F.Barker (Hyacinthaceae). Internet 2 pages.
http://www.plantzafrica.com/plantklm/lachenaliafram.htm.

STEYN, H.M. 2009. 2009-11. *Lachenalia valeriae* G.D.Duncan (Hyacinthaceae). Internet 2 pages.
http://www.plantzafrica.com/plantklm/lachenaliaval.htm.

STRUWIG, M., MIENIE, C.M.S., VAN DEN BERG, J., MUCINA, L. & BUYS, M.H. 2009. AFLPs are incompatible with RAPD and morphological data in *Pennisetum purpureum* (Napier grass). *Biochemical Systematics and Ecology* 37: 645–652.

SWART, B.L., TOLLEY, K.A. & MATTHEE, C.A. 2009. The phylogeography of the Southern rock Agama *(Agama atra)* in the Cape Fold Mountains, South Africa. *Journal of Biogeography* 36: 78–87.

TAYLOR, P.J. & HAMER, M. 2009. Standing on the shoulders of colourful giants: 50 years of zoological research in southern Africa. *African Zoology* 44: 217–231

TILBURY, C.R. & TOLLEY, K.A. 2009a. A new species of dwarf chameleon (Sauria; Chamaeleonidae, *Bradypodion* Fitzinger) from KwaZulu-Natal, South Africa with notes on recent climatic shifts and their influence on speciation in the genus. *Zootaxa* 2226: 43–57.

TILBURY, C.R. & TOLLEY, K.A. 2009b. A re-appraisal of the systematics of the African genus *Chamaeleo* (Reptilia: Chamaeleonidae). *Zootaxa* 2079: 57–68.

TOLLEY, K.A., MAKOKHA, J.S., SWART, B., HOUNIET, D.T. & MATTHEE, C.A. 2009. Comparitive landscape genetics in the Cape Floristic Region with emphasis on predicting the effects of climatic shifts on genetic diversity in lizards, chameleons, agamids and sand lizards. *Molecular Phylogenetics and Evolution* 51: 120–130.

TRIPLET, P. & BARNARD, P. 2009. Intégrer les changements climatiques à la gestion (= Integrating climate change into conservation management). In P. Triplet, *Manuel des conservateurs des aires protégées d'Afrique francophone*: 515–520.
http://www.awely.org/index.php?option=com_content&task=view&id=158&Itemid=108&lang=fr.

UNDERHILL, L.G. & BARNARD, P. 2009. SABAP2 and climate change. *Africa Birds & Birding* 14,6: 79.

UYS, C., HAMER, M. & SLOTOW, R. 2009. Turnover in invertebrate species composition over different spatial scales in Afrotemperate forest in the Drakensberg, South Africa. *African Journal of Ecology* 47: 341–351.

VAN JAARSVELD, E. 2009-02a. *Dregeochloa pumila* (Nees) Conert (Poaceae). Internet 2 pp.
http://www.plantzafrica.com/plantcd/dregeochloapum.htm.

VAN JAARSVELD, E. 2009-02b. *Litanthus pusillus* Harv. (Hyacinthaceae). Internet 2 pp.
http://www.plantzafrica.com/plantklm/litanpusillus.htm.

VAN JAARSVELD, E. 2009-05a. *Aloe nubigena* Groenew. (Asphodelaceae). Internet 3 pp.
http://www.plantzafrica.com/plantab/aloenubigena.htm.

VAN JAARSVELD, E. 2009-05b. *Aloe thompsoniae* Groenew. (Asphodelaceae). Internet 2 pp.
http://www.plantzafrica.com/plantab/aloethompson.htm.

VAN JAARSVELD, E. 2009-08a. *Cotyledon pendens* Van Jaarsv. (Crassulaceae). Internet 3 pp.
http://www.plantzafrica.com/plantcd/cotypendens.htm.

VAN JAARSVELD, E. 2009-08b. *Crassula sericea* Schönland var. *sericea* (Crassulaceae). Internet 3 pp.
http://www.plantzafrica.com/plantcd/crassulaseriseri.htm.

VAN JAARSVELD, E. 2009-11a. *Gasteria glauca* Van Jaarsv. (Asphodelaceae). Internet 3 pp.
http://www.plantzafrica.com/plantefg/gasteriaglauca.htm.

VAN JAARSVELD, E. 2009-11b. *Gasteria rawlinsonii* Oberm. (Asphodelaceae). Internet 3 pp.
http://www.plantzafrica.com/plantefg/gasteriarawlin.htm.

VAN JAARSVELD, E. 2009-12. *Turnera oculata* Story var. *oculata* (Turneraceae). Internet 3 pp.
http://www.plantzafrica.com/planttuv/turnoculocul.htm.

VAN WYK, B-E., BURKE, A., MANNHEIMER, C., MAGEE, A.R., TILNEY, P.M. & ROSSOUW, A. 2010. A new species of *Polemanniopsis* (Apiaceae). *South African Journal of Botany* 76: 153–157.

VAN WYK, E. 2009. New kid on the block: the Early Detection and Rapid Response Programme for emerging invasive alien plants. *Prickly Pear*, December 2,2. Alien Invasive Task Group, SANParks Honorary Rangers.

VERBOOM, G.A., ARCHIBALD, J.K., BAKKER, F.T., BELLSTEDT, D.U., CONRAD, F., DREYER, L.L., FOREST, F., GALLEY, C., GOLDBLATT, P., HENNING, J.F., MUMMENHOFF, K., LINDER, H.P., MUASYA, A.M., OBERLANDER, K.C., SAVOLAINEN, V. & SNIJMAN, D.A. 2009. Origin and diversification of the Greater Cape flora: ancient species repository, hotbed of recent radiation, or both? *Molecular Phylogenetics and Evolution* 51: 44–53.

VILJOEN, C. 2009-04. *Streptocarpus modestus* L.L.Britten (Gesneriaceae). Internet 2 pp.
http://www.plantzafrica.com/plantqrs/strepmodestus.htm.

WALL, K. 2009-02. *Roridula gorgonias* Planch. (Roridulaceae). Internet 2 pp.
http://www.plantzafrica.com/plantqrs/roridulagorgonias.htm.

WALL, K. 2009-03. *Pelargonium scabrum* (Burm.f.) L'Hér. (Geraniaceae). Internet 2 pp.
http://www.plantzafrica.com/plantnop/pelargscabrum.htm.

WALL, K. 2009-05. *Pelargonium fulgidum* (L.) L'Hér. (Geraniaceae). Internet 3 pp.
http://www.plantzafrica.com/plantnop/pelargfulgidum.htm.

WALTERS, M., SMITH, G.F. & ROUX, J.P. 2009. Abstract: Achievements of the African Plants Initiative in South Africa. *South African Journal of Botany* 75: 427.

WANLESS, R.M., RYAN, P.G., ALTWEGG, R., ANGEL, A., COOPER, J. & CUTHBERT, R. 2009. From both sides: dire demographic consequences of carnivorous mice and longlining for the Critically Endangered Tristan albatrosses on Gough Island. *Biological Conservation* 142: 1710–1718.

WELMAN, W.G. 2009-08. *Cucumis metuliferus* E.Mey. ex Naudin (Cucurbitaceae). Internet 4 pp.
http://www.plantzafrica.com/plantcd/cucumismet.htm.

WILLIS, C.K. 2009. Amidst the butterflies of southwestern Angola. *Metamorphosis* 20,3: 74–88.

WILSON, J.R.U., DORMONTT, E.E., PRENTIS, P.J., LOWE, A.J. & RICHARDSON, D.M. 2009. Biogeographic concepts define invasion biology. *Trends in Ecology and Evolution* 24: 586.

WOLLENBERG, K.C. & MEASEY, G.J. 2009. Why colour in subterranean vertebrates? Exploring the evolution of colour patterns in caecilian amphibians. *Journal of Evolutionary Biology* 22: 1046–1056.

XABA, P. 2009-04. *Encephalartos cycadifolius* (Jacq.) Lehm. (Zamiaceae). Internet 2 pp.
http://www.plantzafrica.com/plantefg/encephcycad.htm.

XABA, P. 2009-07. *Encephalartos caffer* (Thunb.) Lehm. (Zamiaceae). Internet 2 pp.
http://www.plantzafrica.com/plantefg/encephcaffer.htm.

XABA, P. 2009-11. *Encephalartos aplanatus* Vorster (Zamiaceae). Internet 3 pp.
http://www.plantzafrica.com/plantefg/encephaplantus.htm.

Bothalia 40,2: 239–249 (2010)

Guide for authors to *Bothalia*

This guide is updated when necessary and includes an index. **Important points and latest additions appear in bold type.**

Bothalia is named in honour of General Louis Botha, first Premier and Minister of Agriculture of the Union of South Africa. This house journal of the South African National Biodiversity Institute (SANBI), Pretoria, is devoted to the furtherance of botanical science. The main fields covered are taxonomy, ecology, anatomy and cytology. Two parts of the journal and an index to contents, authors and subjects are published annually.

1 EDITORIAL POLICY

1.1 *Bothalia* welcomes original papers dealing with flora and vegetation of southern Africa and related subjects. Full-length papers and short notes, as well as book reviews and obituaries of botanists, are accepted. The editor should be notified that an article is part of a series of manuscripts; please submit a list of the parts of a series; all parts should preferably be published in one journal.

1.2 Submission of a manuscript to *Bothalia* implies that it has not been published previously and is not being considered for publication elsewhere.

1.3 Authors whose first language is not English are requested to have their MS edited by an English speaker before submission.

1.4 Articles are assessed by referees, both local and overseas. Authors are welcome to suggest possible referees to judge their work. Authors are responsible for the factual correctness of their contributions. *Bothalia* maintains an editorial board (see title page) to ensure that international standards are upheld.

1.5 **Page charges:** as stated in our notification included in volume 23,1 (May 1993), MSS submitted for publication in *Bothalia* are subject to payment of page charges of R125,00 per printed page, VAT included. The following are exempt from these charges: 1, SANBI members; 2, persons/institutions who have been granted exemption by the Executive Committee of the SANBI; 3, authors of contributions requested by the Editor; 4, contributors to the column '*FSA* contributions'. The Editor's decision on the number of pages is final. An invoice will be sent to the author, who must arrange for payment as soon as possible to SANBI, Publications Section, Private Bag X101, Pretoria 0001.

1.6 Deadline dates for submission of MS: for possible inclusion of the MS for the May issue—May of the previous year, and for the October issue—October of the previous year.

2 REQUIREMENTS FOR A MANUSCRIPT

2.1 The original manuscript should be typed on one side of A4-size paper, double line spacing throughout (including abstract, tables, captions of figures, literature references), and have a margin of at least 30 mm all round. **Tables should be typed in single line spacing on a separate page at the end of the article.** Three photocopies (all pages photocopied on both sides of the paper, including figures, to reduce weight for postage) of all items, including text, line drawings, tables and lists should be submitted, and the author should retain a complete set of copies. **High quality photocopies** of each figure should be submitted for review purposes. **The electronic version of the text should be submitted with the manuscript.**

2.2 Papers should conform to the general style and layout of recent issues of *Bothalia* (from volume 26 onwards).

2.3 Material should be presented in the following sequence: title page with title, name(s) of author(s), address(es) of author(s) and mention of granting agencies, keywords and abstract.

2.4 The sequence continues with Introduction and aims, Contents (see 8), Material and methods, Results, Interpretation (Discussion), Specimens examined (in revisions and monographs), Acknowledgements, References, Index of names (recommended for revisions dealing with more than about 15 species), Tables, Captions of figures and figures. In the case of short notes, obituaries and book reviews, keywords and an abstract are omitted.

2.5 All pages must be numbered **i.e. typed consecutively on the top right-hand corner of the page,** beginning with the title page to those with references, tables, captions of figures and figures.

2.6 Special characters: use your own word or code that is unique and self-explanatory, enclosed between ANGLE BRACKETS, e.g. <mu>m for µm. Please supply us with a list of the codes.

2.7 Use a non-breaking space (in MS Word—Ctrl, shift, space) to keep two elements together on the same line, e.g. 3 500.

2.8 DO NOT JUSTIFY LINES.

2.9 Do not break words, except hyphenated words.

2.10 A **hyphen** is designated as one dash, with no space between the letter and the dash, e.g. ovate-lanceolate. See also **17.7.**

2.11 An **N-dash** is typed in MS Word code (alt + 0150) or as **three** hyphens with no space between the letter and the hyphen, e.g. 2- - -5 mm (typeset, it looks like this, 2–5 mm). See also **17.7.**

2.12 An **M-dash** is typed in MS Word code (alt + 0151) or as **two** hyphens with no space between the letter and the hyphen, e.g. computers- -what a blessing! (typeset, it looks like this: computers—what). See also **17.7.**

2.13 **Do not use a double space anywhere** between words, after commas, full stops, colons, semicolons or exclamation marks.

2.14 Use lower case x as times sign, with one space on either side of the x, e.g. 2 x 3 mm.

2.15 Use single (not double) opening and closing quotes, e.g. the so-called 'stiffy' refers to a rigid diskette. In MSWord the codes are alt + 0145 and alt + 0146.

2.16 Keys—put only three leader dots before number of taxon (with one space before and after each dot), regardless of how far or near the word is from the right margin, e.g. . . . 1. *R. ovata* (see 13.18).

3 REQUIREMENTS FOR ELECTRONIC FILES

3.1 USE NORMAL STYLE ONLY.

3.2 Provide electronic files on CD or send via the e-mail to momberg@sanbi.org or germishuizen@sanbi.org. Three hard copies of the MS should also be POSTED to the editor.

3.3 Data should be in MSWord. An RTF file is preferable because it retains the formatting.

3.4 All lines, headings, keys, etc., should start flush at the margin, therefore NO INDENTATIONS, FOOTNOTES, TABS OR STYLES of any kind.

3.5 In MS Word, italics and bold should be used where necessary.

3.6 Paragraphs and headings are delineated by a carriage return (ENTER) but no indentation.

3.7 Graphics i.e. drawings, graphs or photographs: submit in a separate file, do not include it in the text.

3.8 Image files with a bigger file size than 2MB cannot be e-mailed as the SANBI has a 2MB limitation on the network's firewall at Head Office. Files smaller than 2MB should be emailed to: **b.momberg@sanbi.org.za.** Image files bigger than 2 MB should be provided on a CD or can be copied to the SANBI FTP site by using the following link: ftp://ftp.sanbi.org/incoming/. Permission needs to be obtained to copy material to the FTP site. Please contact the editor for details.

3.9 Provide an image file originated in Corel Draw (version 14 or lower), as a CDR file, with fonts converted to curves. Submit image files originated in other drawing programmes as encapsulated postscript files (EPS). The conversion to TIF or other file extensions will be accommodated by SANBI Graphics (see 12.2–12.4).

3.10 If extensive changes to image files are proposed by the editor, the author will be contacted and the specific image file will have to be re-submitted after the indicated corrections have been implemented.

3.11 **Do NOT include tracked changes when submitting a MS on a CD or electronically.**

4 AUTHOR(S)

When there are several authors, the covering letter should indicate clearly which of them is responsible for correspondence and, if possible, telephonically available while the article is being processed. The contact address, telephone number and email address should be mentioned if they differ from those given on the letterhead.

5 TITLE

The title should be as concise and as informative as possible. In articles dealing with taxonomy or closely related subjects, the family of the taxon under discussion (see also 13.2) should be mentioned in brackets but author citations should be omitted from plant names (see also 13.6).

6 KEYWORDS

Up to 10 keywords (or index terms) should be provided in English in alphabetical sequence. The following points should be borne in mind when selecting keywords:

6.1 Keywords should be unambiguous, internationally acceptable words and not recently coined little-known words.

6.2 They should be in a noun form and verbs should be avoided.

6.3 They should not consist of an adjective alone; adjectives should be combined with nouns.

6.4 They should not contain prepositions.

6.5 The singular form should be used for processes and properties, e.g. evaporation.

6.6 The plural form should be used for physical objects, e.g. augers.

6.7 Location (province and/or country); taxa (species, genus, family) and vegetation type (community, veld type, biome) should be used as keywords.

6.8 Keywords should be selected hierarchically where possible, e.g. both family and species should be included.

6.9 They should include terms used in the title.

6.10 They should answer the following questions:

6.10.1 What is the *active concept* in the document (activity, operation or process).

6.10.2 What is the *passive concept* or object of the active process (item on which the activity, operation or process takes place).

6.10.3 What is the means of accomplishment or how is the active concept achieved (technique, method, apparatus, operation or process).

6.10.4 What is the environment in which the active concept takes place (medium, location).

6.10.5 What are the independent (controlled) and dependent variables?

6.11 Questions 6.10.1 to 6.10.3 should preferably also be answered in the title.

7 ABSTRACT

7.1 An abstract of no more than 200 words should be provided. Abstracts are of great importance and should convey the essence of the article.

7.2 It should refer to the geographical area concerned and, in taxonomic articles, mention the number of taxa treated. It should not contain information not appearing in the article.

7.3 In articles dealing with taxonomy or closely related subjects all taxa from the rank of genus downwards should be accompanied by their author citations (see also 13.6).

7.4 Names of new taxa and new combinations should not be italicized but put in bold. If the article deals with too many taxa, only the important ones should be mentioned.

8 TABLE OF CONTENTS

A table of contents should be given for all articles longer than about 60 typed pages, unless they follow the strict format of a taxonomic revision.

9 ACKNOWLEDGEMENTS

Acknowledgements should be kept to the minimum compatible with the requirements of courtesy. Please give all the initials of the person(s) you are thanking.

10 LITERATURE REFERENCES

In text

10.1 Literature references in the text should be cited as follows: 'Jones & Smith (1986) stated...', or '...(Jones & Smith 1986)' or (Ellis 1988: 67) when giving a reference simply as authority for a statement. For treatment of literature references in taxonomic papers see 14.

10.2 When more than two authors are involved in the paper, use the name of the first author followed by *et al.*

10.3 When referring to more than one literature reference, they should be arranged chronologically and separated by a semicolon, e.g. (Nixon 1940; Davis 1976; Anon. 1981, 1984).

10.4 Titles of books and names of journals should preferably not be mentioned in the text. If there is good reason for doing so, they should be treated as described in 10.12 and 10.13.

10.5 Personal communications are given only in the text, not in the list of references. Please add the person's full initials to identify the person more positively, e.g. C. Boucher pers. comm.

In References at end of article

10.6 References of the same author are arranged in chronological sequence.

10.7 Where two or more references by the same author are listed in succession, the author's name is repeated with every reference, except in an obituary, where the name of the deceased in the list of publications (not in the references) is replaced by an N-dash.

10.8 All publications referred to in the text, including those mentioned in full in the treatment of correct names in taxonomic papers, but no others, and no personal communications, are listed at the end of the manuscript under the heading References.

10.9 The references are arranged alphabetically according to authors and chronologically under each author, with a, b, c, etc. added to the year, if the author has published more than one work in a year. This sequence is retained when used in the text, irrespective of the chronology.

10.10 If an author has published both on his own and as a senior author with others, the solo publications are listed first and after that, in strict alphabetical sequence, those published with one or more other authors.

10.11 Author names are typed in **capital letters**.

10.12 Titles of journals and of books are written out in full and are italicized as follows: *Transactions of the Linnean Society of London* 5: 171–217, or *Biology and ecology of weeds*: 24.

10.13 Titles of books should be given as in *Taxonomic literature*, edn 2 by Stafleu & Cowan and names of journals as in the latest edition of *World list of scientific periodicals*.

10.14 Examples of references:

Collective book or Flora

BROWN, N.E. 1909. Asclepiadaceae. In W.T. Thiselton-Dyer, *Flora capensis* 6,2: 518–1036. Reeve, London.

CUNNINGHAM, A.B. 1994. Combining skills: participatory approaches in biodiversity conservation. In B.J. Huntley, Botanical diversity in southern Africa. *Strelitzia* 1: 149–167. National Botanical Institute, Pretoria.

Book

DU TOIT, A.L. 1966. *Geology of South Africa*, edn 3: 10–50. S.M. Haughton (ed.). Oliver & Boyd, London.

HUTCHINSON, J. 1946. *A botanist in southern Africa*: 69. Gawthorn, London.

Journal

DAVIS, G. 1988. Description of a proteoid-restioid stand in Mesic Mountain Fynbos of the southwestern Cape and some aspects of its ecology. *Bothalia* 18: 279–287.

SMOOK, L. & GIBBS RUSSELL, G.E. 1985. Poaceae. *Memoirs of the Botanical Survey of South Africa* No. 51: 45–70.

STEBBINS, G.L. Jr. 1952. Aridity as a stimulus to plant evolution. *American Naturalist* 86: 35–44.

In press, in preparation

TAYLOR, H.C. in press. *A reconnaissance of the vegetation of Rooiberg State Forest*. Technical Bulletin, Department of Forestry.

VOGEL, J.C. 1982. *The age of the the Kuiseb river silt terrace at Homeb. Palaeoecology of Africa* 15. In press.

WEISSER, P.J., GARLAND, J.F. & DREWS, B.K. in prep. Dune advancement 1937–1977 and preliminary vegetation succession chronology at Mlalazi Nature Reserve, Natal, South Africa. *Bothalia*.

Thesis

KRUGER, F.J. 1974. *The physiography and plant communities of the Jakkalsrivier Catchment*. M.Sc. (Forestry) thesis, University of Stellenbosch.

MUNDAY, J. 1980. *The genus* Monechma *Hochst*. (*Acanthaceae tribe Justiciae*) *in southern Africa*. M.Sc. thesis, University of the Witwatersrand, Johannesburg.

Miscellaneous paper, report, unpublished article, technical note, congress proceedings

ANON. no date. *Eetbare plante van die Wolkberg*. Botanical Research Unit, Grahamstown. Unpublished.

BAWDEN, M.G. & CARROL, D.M. 1968. *The land resources of Lesotho*. Land Resources Study No. 3, Land Resources Division, Directorate of Overseas Surveys, Tolworth.

BOUCHER, C. 1981. Contributions of the Botanical Research Institute. In A.E.F. Heydorn, *Proceedings of workshop research in Cape estuaries*: 105–107. National Research Institute for Oceanology, CSIR, Stellenbosch.

NATIONAL BUILDING RESEARCH INSTITUTE 1959. *Report of the committee on the protection of building timbers in South Africa against termites, woodboring beetles and fungi*, edn 2. CSIR Research Report No. 169.

11 TABLES (also electronic submissions)

11.1 Each table should be presented on a separate sheet and be assigned an Arabic numeral, i.e. the first table mentioned in the text is marked ‘Table 1’.

11.2 In the captions of tables the word ‘TABLE’ is written in capital letters. See recent numbers of *Bothalia* for the format required.

11.3 Avoid vertical lines, if at all possible. Tables can often be reduced in width by interchanging primary horizontal and vertical heads.

12 FIGURES (original or electronic submissions)

12.1 Line drawings (original artwork) should be in jet-black Indian ink, on fine art paper, 200 gsm. Lines should be clear enough to accommodate reduction. Do not use draughtman’s film as it causes problems with the scanning process.

12.2 Drawings in pencil will not be accepted.

12.3 Provide original drawings electronically as bitmap TIF files, 600 dpi or higher. Provide photographs electronically as either TIF or JPG files, 600 dpi or higher. At the request of the Author, the Publications Section of SANBI will assist with the scanning of original material. Figures should be planned to fit, after reduction, into a width of either 80, 118 or 165 mm, with a maximum vertical length of 230 mm. Allow space for the caption in the case of figures that will occupy a whole page.

12.4 Graphs and histograms should be submitted as stipulated in 3.9, or as TIF or JPG files at a resolution of 600 dpi or higher if generated in other programmes. Graphs and histograms generated in EXCEL or MSWord, should be provided as is. File conversion into the correct format will be accommodated by SANBI Graphics. Please do not supply embedded graphics in the documents or files that are optimized for screen use. Do not submit graphs and histograms in colour. If shading is used it should be easily discernible.

12.5 Photographs should be of excellent quality on glossy paper with clear detail and moderate contrast so that the figures can be scanned without retouching them electronically. If submitted electronically, provide as a TIF or JPG file at 600 dpi or higher and not as a DOC, PDF, EXCEL or POWERPOINT file.

12.6 Photograph mosaics should be submitted as **SEPARATE** photographs or TIF/JPG files at 600 dpi or higher, as well as a photocopy/layout of the mosaic. Final layout of the mosaic will be done by our graphics department.

12.7 Do not number the original images but include a scale bar. Indicate the lettering on the photocopy and not on the original image or electronic copy.

12.8 If several illustrations are treated as components of a single composite figure they should be designated by capital letters.

12.9 Note that the word ‘Figure’ should be written out in full, both in the text and the captions and should begin with a capital ‘F’ (but see 14.7 for taxonomic papers).

12.10 In the text the figure reference is then written as in the following example: ‘The stamens (Figure 4A, B) are...’

12.11 In captions, ‘FIGURE’ is written in capital letters.

12.12 Scale bars or scale lines should be used on figures.

12.13 In figures accompanying taxonomic papers, voucher specimens should be given in the relevant caption.

12.14 Figures are numbered consecutively with Arabic numerals in the order they are referred to in the text. These numbers, as well as the author’s name and an indication of the top of the figure, must be written in soft pencil on the back of all figures.

12.15 Captions of figures should not be pasted under the photograph or drawing and should also not be included in any electronic version of the figures.

12.16 Captions of figures should be collected together and typed at the end of the MS and headed *Captions for figures*.

12.17 Authors should indicate in pencil in the text where they would like the figures to appear.

12.18 Authors wishing to have the originals of figures returned must inform the editor in the original covering letter and must mark each original 'To be returned to author'.

12.19 Authors wishing to use illustrations already published elsewhere must obtain written permission before submitting the manuscript and inform the editor of this fact.

12.20 It is strongly recommended that taxonomic articles include dot maps as figures to show the distribution of taxa. Maps will be reduced to column width (80 mm): the symbols and numbers used must be large enough to stand reduction. The maps should show: numbered grid lines of latitude and longitude; the provinces of South Africa; and a scale line. Maps of neighbouring countries should be treated in the same way, with bordering states clearly labelled. For orientation purposes, a small inset map should appear in a corner of the figure.

12.21 ArcView GIS maps are acceptable. The layout representing all the appropriate themes (including grid lines) should be submitted as an encapsulated postscript file (EPS).

12.22 Colour figures are permitted only if: a) it will clarify the article and b) the cost of reproduction and printing is borne by the author.

12.23 Magnification of figures in the caption should be given for the size as submitted.

13 TEXT

13.1 As a rule, authors should use the plant names (but not of all authors of plant names—see 13.6) as listed in PRECIS (National Herbarium **PRE**toria **C**omputerised **I**nformation **S**ystem).

13.2 Names of genera and infrageneric taxa are usually italicized, with the author citation (where relevant: see 13.6) not italicized. Exceptions include names of new taxa in the abstract, correct names given in the synopsis or in paragraphs on species excluded from a given supraspecific group in taxonomic articles; in checklists and in indices, where the position is reversed, correct names are not italicized and synonyms are italicized.

13.3 Names above generic level are not italicized.

13.4 In articles dealing with taxonomy, the complete scientific name of a plant (with author citation) should be given at the first mention in the text. The generic name should be abbreviated to the initial thereafter, except where intervening references to other genera with the same initial could cause confusion (see 16.6).

13.5 In normal text, Latin words are italicized, but in the synopsis of a species, Latin words such as *nom. nud.* and *et al.* are not italicized (see 16.4, 17.2).

13.6 In accordance with Garnock-Jones & Webb (1996) in *Taxon* 45: 285, 286, authors of plant names are not to be added to plant names except in taxonomic papers. Names of authors of plant names should agree with the list published by the Royal Botanic Gardens, Kew, entitled, *Authors of plant names*, edited by R.K. Brummitt & C.E. Powell (1992).

13.7 Modern authors not included in the list should use their full name and initials when publishing new plant names. Other author names not in the list should be in agreement with the recommendations of the Code.

13.8 Names of authors of publications are written out in full, without initials, except in the synonymy in taxonomic articles where they are treated like names of authors of plant names.

13.9 Names of plant collectors are italicized whenever they are linked to the number of a specimen. The collection number is also italicized, e.g. *Acocks 14407*.

13.10 Surnames beginning with 'De', 'Du' or 'Van' begin with a capital letter unless preceded by an initial.

13.11 For measurements use only units of the International System of Units (SI). In taxonomic papers only mm and m, should be used; in ecological papers cm or m should be used.

13.12 The use of '±' is preferred to c. or ca (see 17.8).

13.13 Numbers 'one' to 'nine' are spelt out in normal text, and from 10 onwards they are written in Arabic numerals.

13.14 In descriptions of plants, numerals are used throughout. Write 2.0–4.5 (not 2–4.5) and 2.0–4.5   6–9. When counting members write 2 or 3 (not 2–3), but 2–4.

13.15 Abbreviations should be used sparingly but consistently. No full stops are placed after abbreviations ending with the last letter of the full word (e.g. edition = edn; editor = ed.); after units of measure; after compass directions; after herbarium designations; after countries, e.g. USA and after well-known institutions, e.g. CSIR.

13.16 Apart from multi-access keys, indented keys should be used with couplets numbered 1a–1b, 2a–2b, etc. (without full stops thereafter).

13.17 Keys consisting of a single couplet have no numbering.

13.18 Manuscripts of keys should be presented as in the following example:

1a Leaves closely arranged on elongated stem; a submerged aquatic with only capitula exserted . . . 1b. *E. setaceum* var. *pumilum*

1b Leaves in basal rosettes; stems suppressed; small marsh plants, ruderals or rarely aquatics:

2a Annuals, small, fast-growing pioneers, dying when habitat dries up; capitula without coarse white setae; receptacles cylindrical:

3a Anthers white . . . 2. *E. cinereum*

3b Anthers black . . . 3. *E. nigrum*

2b Perennials, more robust plants; capitula sparsely to densely covered with short setae:

13.19 Herbarium voucher specimens should be referred to wherever possible, not only in taxonomic articles.

13.20 The word Figure should be written out in full and should begin with a capital F, also in captions where the whole word is in capital letters (see 12.8–12.11).

14 SPECIES TREATMENT IN TAXONOMIC PAPERS

14.1 The procedure to be followed is illustrated in the example (17.2), which should be referred to, because not all steps are described in full detail.

14.2 The correct name (bold, not italicized) is to be followed by its author citation (italicized) and the full literature reference, with the name of the publication written out in full (not italicized).

14.3 Thereafter all literature references, including those of the synonyms, should only reflect author, page and year of publication, e.g. C.E.Hubb. in Kew Bulletin 15: 307 (1960); Boris et al.: 14 (1966); Boris: 89 (1967); Sims: t. 38 (1977); Sims: 67 (1980).

14.4 The description and the discussion should consist of paragraphs commencing, where possible, with italicized leader words such as *flowering time, etymology, diagnostic characters, distribution and habitat*, with a colon following the leader word and the first word of the sentence beginning with a lower case letter.

14.5 When more than one species of a given genus is dealt with in a paper, the correct name of each species should be prefixed by a sequential number followed by a full stop. Infraspecific taxa are marked with small letters, e.g. 1b., 12c., etc.

14.6 Names of authors are written as in 13.6, irrespective of whether the person in question is cited as the author of a plant name or of a publication.

14.7 The word 'figure' is written as 'fig.', and 't.' is used for both 'plate' and 'tablet' (but see 12.9 for normal text).

14.8 Literature references providing good illustrations of the species in question may be cited in a paragraph commencing with the word Illustrations followed by a colon. This paragraph is given after the last paragraph of the synonymy, see 17.2.

14.9 When new combinations are made, the full literature reference must be given for the basionym, e.g.:

Antimima saturata (*L.Bolus*) *H.E.K. Hartmann*, comb. nov.

Ruschia saturata L.Bolus in Notes on Mesembrianthemum and allied genera, part 2: 122 (1929). *Mesembryanthemum atrocinctum* N.E.Br.: 32 (1930). Type: *Pillans BOL18952* (BOL, holo.–photo!).

14.10 Treatment of subspecies. Example:

37. **Acacia robusta** *Burch.*, Travels in the interior of southern Africa: 442 (1824); Harv.: 281 (1862); Oliv.: 349 (1871) pro parte excl. specim. *Welwitsch*; Palmer & Pitman: 807 (1973). Type: Cape Province, Kuruman Dist. Takoon [Litakun], *Burchell 2265* (K, holo.!).

[The species description encompassing the subspecific characteristics and notes on distribution should follow here.]

Two subspecies are distinguished:

Leaf rachis glabrous or almost so; pods straight or slightly curved . . . . .37a. subsp. *robusta*

Leaf rachis sparsely to densely pubescent; pods usually ± falcate . . . . 37b. subsp. *clavigera*

37a. subsp. **robusta.**

Brenan in Flora zambesiaca 3,1: 103 (1970); Ross: 37 (1971).

A. robusta Burch.: 442 (1824). [this is the basionym]

[The diagnostic description of the subspecies or reference to above key and notes on distribution should follow here.]

37b. subsp. **clavigera** (*E.Mey.*) *Brenan* in Flora zambesiaca 3,1: 104 (1970); Ross: 193 (1973). Type: Natal, near Port Natal [Durban], *Drège s.n.* (K, iso.!; P, fragm.!).

A. clavigera E.Mey., Commentariorum 1: 168 (1836); Benth.: 510 (1875); Brenan: 365 (1958).

[The diagnostic description of the subspecies or reference to above key and notes on distribution should follow here.]

15 CITATION OF SPECIMENS

15.1 Type specimen in synopsis: the following should be given (if available): country (if not in RSA), province, grid reference (at least for new taxa), locality as given by original collector, modern equivalent of collecting locality in square brackets (if relevant, e.g. Port Natal [now Durban]), quarter-degree square, date of collection (optional), collector's name and collecting number (both italicized).

15.2 The abbreviation s.n. (*sine numero*) is given after the name of a collector who usually assigned numbers to his collections but did not do so in the specimen in question (see 15.11), or the herbarium number can then be cited with no space between the herbarium and its number e.g. *Marloth SAM691* (see 17.2). The herbaria in which the relevant type(s) are housed are indicated by means of the abbreviations given in the latest edition of *Index Herbariorum*.

15.3 The holotype (holo.) and its location are mentioned first, followed by a semicolon, the other herbaria are arranged alphabetically, separated by commas.

15.4 Authors should indicate by means of an exclamation mark (!) which of the types have been personally examined.

15.5 If only a photograph, microfiche, electronic or Aluka image was seen, write as follows: *Anon. 422* (X, holo.–BOL, photo.!), or Anon. 422 (X, holo.–Aluka image, website accessed 14-08-2009) or Zeyher 2908 (KW, holo.e!).

15.6 Lectotypes or neotypes should be chosen for correct names without a holotype. It is not necessary to lectotypify synonyms.

15.7 When a lectotype or a neotype are newly chosen, this should be indicated by using the phrase 'here designated' (see 17.2). If reference is made to a previously selected lectotype or neotype, the name of the designating author and the literature reference should be given. In cases where no type was cited, and none has subsequently been nominated, this may be stated as 'not designated'.

15.8 In brief papers mentioning only a few species and a few cited specimens the specimens should be arranged according to the grid reference system: Provinces/countries (typed in capitals) should be cited in the following order: Namibia, Botswana, Limpopo (previously Northern Transvaal, Northern Province), North-West (previously northeastern Cape and southwestern Transvaal), Gauteng (previously PWV), Mpumalanga (previously Eastern Transvaal), Free State (previously Orange Free State), Swaziland, KwaZulu-Natal (previously Natal), Lesotho, and Northern Cape, Western Cape and Eastern Cape (Figure 1).

15.9 Grid references should be cited in numerical sequence.

15.10 Locality records for specimens should preferably be given to within a quarter-degree square. Records from the same one-degree square are given in alphabetical order, i.e (–AC) precedes (–AD), etc. Records from the same quarter-degree square are arranged alphabetically according to the collectors' names; the quarter-degree references must be repeated for each specimen cited.

15.11 The relevant international code of the herbaria in which a collection was seen should be given in brackets after the collection number; the codes are separated by commas. The following example will explain the procedure:

KWAZULU-NATAL.—2731 (Louwsburg): 16 km E of Nongoma, (–DD), 10-10-1960, *Pelser 354* (BM, K, PRE); near Dwarsrand, *Van der Merwe 4789* (BOL, M). 2829 (Harrismith): near Groothoek, (–AB), *Smith 234*; Koffiefontein, (–AB), *Taylor 720* (PRE); Cathedral Peak Forest Station, (–CC), 8 July 1905, *Marriot s.n.* (KMG); Wilgerfontein, *Roux 426*. Grid ref. unknown: Sterkstroom, *Strydom 12* (NBG).

15.12 For records from outside southern Africa authors should use degree squares without names, e.g.:

KENYA.—0136: Nairobi plains beyond race course, *Napier 485*.

15.13 Monographs and revisions: in the case of all major works of this nature it is assumed that the author has investigated the relevant material in all major herbaria and that he has provided the specimens seen with determinavit labels. It is assumed further that the author has submitted distribution maps for all relevant taxa and that the distribution has been described briefly in words in the text. Under the heading 'Vouchers' no more than five specimens should be cited, indicating merely the collector and the collector's number (both italicized). Specimens are alphabetically arranged according to collector's name. If more than one specimen by the same collector is cited, they are arranged numerically and separated by a comma. A collector's name and the voucher number(s) is separated from the next collector by a semicolon. The purpose of the cited specimens is not to indicate distribution but to convey the author's concept of the taxon in question.

15.14 The herbaria in which the specimens are housed are indicated by means of the abbreviation given in the latest edition of *Index Herbariorum*. They are given between brackets, arranged alphabetically and separated by commas behind every specimen as in the following example:

Vouchers: *Arnold 64* (PRE); *Fisher 840* (NH, NU, PRE); *Flanagan 831* (GRA, PRE), *840* (NH, PRE); *Marloth 4926* (PRE, STE); *Schelpe 6161, 6163, 6405* (BOL); *Schlechter 4451* (BM, BOL, GRA, K, PRE).

15.15 If long lists of specimens are given, list them together before Acknowledgements under the heading *Specimens examined*. They are arranged alphabetically by the collector's name and then numerically for each taxon. The species is indicated in brackets by the number that was assigned to it in the text and any infraspecific taxa by a small letter; this number follows the specimen number. If more than one genus is dealt with in a given article, the first species of the first genus mentioned is indicated as 1.1. This is followed by the international herbarium designation. Note that the name of the collector and the collection number are italicized:

Acocks 14724 (1.13a) BOL, K, P; *12497* (2.1b) BM, K, PRE. *Archer 1507* (1.4) BM, G.

Barker 9738 (1) NBG; *1916* (2) NBG; *295, 4766, 9478, 9796, 10330* (4) NBG; *1919* (5) BOL, NBG; *1917,1923, 1935, 2570, 2606, 2646, 3332, 4198, 4858, 10534, 10801* (5) NBG. *Burchell 2847* (2.8c) MB, K. *Burman 2401* (3.3) MO, S. *B.L. Burtt 789* (2.6) B, KMG, STE.

Esterhuysen 11497 (1) BOL; *1433* (5) BOL; *71402* (5) NBG.

16 SYNONYMS

16.1 In a monograph or a revision covering all of southern Africa, all synonyms based on types of southern African origin, or used in southern African literature, should be included.

16.2 Illegitimate names are designated by *nom. illeg.* after the reference, followed by non with the author and date, if there is an earlier homonym.

16.3 Nomina nuda (*nom. nud.*) and invalidly published names are excluded unless there is a special reason to cite them, for example if they have been used in prominent publications.

16.4 In normal text, Latin words are italicized, but in the synopsis of a species Latin words such as *nom. nud., et al.* are not italicized (see 13.5, 17.2).

16.5 Synonyms should be arranged chronologically into groups of nomenclatural synonyms, i.e. synonyms based on the same type, and the groups should be arranged chronologically by basionyms, except for the basionym of the correct name which is dealt with in the paragraph directly after that of the correct name.

16.6 When a generic name is repeated in a given synonymy it should be abbreviated to the initial, except where intervening references to other genera with the same initial could cause confusion (see 13.4).

17 DESCRIPTION AND EXAMPLE OF SPECIES TREATMENT

17.1 Descriptions of all taxa of higher plants should, where possible, follow the sequence: Habit; sexuality; underground parts (if relevant). *Indumentum* (if it can be easily described for the whole plant). *Stems/branches*. *Bark*. *Stipules*. *Leaves*: arrangement, petiole absent/present, pubescence; blade: shape, measurements, apex, base, texture, colour; margin; midrib: above/below; petiole. *Inflorescence*: type, shape, measurements, position; bracts/bracteoles, involucral bracts: inner, outer. *Flowers*: shape, measurements, sex, colour. *Receptacle*. *Calyx*. *Corolla*. *Disc*. *Androecium*. *Gynoecium*. *Fruit*. *Seeds* (apply the same sequence of relevant features as in flowers). *Flowering time*. *Chromosome number (reference)*. *Conservation status*. Figure number (word written out in full).

17.2 Example (not factual for this species):

1. **Englerophytum magalismontanum** (*Sond.*) *T.D.Penn.*, The genera of Sapotaceae: 252 (1991). Type: Gauteng, Magaliesberg, *Zeyher 1849* (S, holo.–BOL, photo.!).

Bequaertiodendron magalismontanum (Sond.) Heine & Hemsl.: 307 (1960); Codd: 72 (1964); Elsdon: 75 (1980).

Chrysophyllum magalismontanum Sond.: 721 (1850); Harv.: 812 (1867); Engl.: 434 (1904); Bottmar: 34 (1919). *Zeyherella magalismontana* (Sond.) Aubrév. & Pellegr.: 105 (1958); Justin: 97 (1973).

Chrysophyllum argyrophyllum Hiern: 721 (1850); Engl.: 43 (1904). *Boivinella argyrophylla* (Hiern) Aubrév. & Pellegr.: 37 (1958); Justin et al.: 98 (1973). Types: Angola, *Welwitsch 4828* (BM!, lecto., here designated; PRE!); Angola, *Welwitsch s.n.* (BM!).

Chrysophyllum wilmsii Engl.: 4, t. 16 (1904); Masonet: 77 (1923); Woodson: 244 (1937). *Boivinella wilmsii* (Engl.) Aubrév. & Pellegr.: 39 (1958); Justin: 99 (1973). Type: without locality and collector [B, holo.†; K!, P!, lecto., designated by Aubrév. & Pellegr.: 38 (1958), PRE!, S!, W!, Z!].

Bequaertiodendron fruticosa De Wild.: 37 (1923), non Bonpl.: 590 (1823); D.Bakker: 167 (1929); H.Fr.: 302 (1938); Davy: 640 (1954); Breytenbach: 117 (1959); Clausen: 720 (1968); Palmer: 34 (1969). Type: Mpumalanga, Tzaneen Dist., *Granville in Herb. Pillans K48625* (K, holo.!; G!, P!, PRE!, S!–**Aluka image, website accessed 14-08-2009).**

B. fragrans auct. non Oldemann: Glover: 149, t. 19 (1915); Henkel: 226 (1934); Stapelton: 6 (1954).

Illustrations: Harv.: 812 (1867); Henkel: t. 84 (1934?); Codd: 73 (1964); Palmer: 35 (1969).

Woody perennial; main branches up to 0.4 m long, erect or decumbent, grey woolly-felted, leafy. *Bark* smoothish, pale, beige-brown, flaking; lenticellate, splitting longitudinally. *Stipules* paired, spines up to 50 × 45 × ± 2 mm, unmistakeably large and flattened, roughly triangular in outline, the flared basiscopic lobe margins folded over in larger stipules, spines held at ± 90° to stem. *Stem* erect, simple or 1- or 2-branched, either from base or from upper stem nodes. *Leaves* linear to oblanceolate, 3–10(–23) × 1.0–1.5(–4.0) mm, obtuse, base broad, half-clasping. *Heads/Inflorescence* heterogamous, campanulate, 7–8 × 5 mm, solitary, sessile at tip of axillary shoots; involucral bracts in 5 or 6 series, inner exceeding flowers, tips subopaque, white, very acute. *Receptacle* nearly smooth. *Flowers* ± 23–30, 7–11 male, 16–21 bisexual, yellow, tipped pink. *Stamens* unilateral and declinate; filaments 7–9 mm long, exserted for 7–8 mm; anthers 3–4 mm long, dull pink. *Ovary* ovoid, ± 3.5 mm long; style dividing near apex of anthers, style branches 3–4 mm long, recurved. *Pappus* bristles very many, equalling corolla, scabridulous. *Capsules/achenes* subglobose, 3-lobed, 6–7 mm long. *Seeds* tetrahedral, colliculate, ± 2 mm long. *Flowering time*: September. *Chromosome number*: 2n = 22. Figure 23B.

17.3 As a rule, shape should be given before measurements.

17.4 In general, if an organ has more than one of the parts being described, use the plural, otherwise use the singular, for example, petals of a flower but blade of a leaf.

17.5 Language must be as concise as possible, using participles instead of verbs.

17.6 Dimension ranges should be cited as in 17.2.

17.7 Care must be exercised in the use of dashes and hyphens. A *hyphen* is a short stroke joining two syllables of a word, e.g. ovate-lanceolate or sea-green, with no space between the letter and the stroke. An *N-dash* (*en*) is a longer stroke commonly used instead of the word 'to' between numerals, '2–5 mm long' (do not use it between words but rather use the word 'to', e.g. 'ovate to lanceolate'; it is produced by typing three hyphens with spaces in between, or in MS Word the code is alt + 0150. An *M-dash* (*em*) is a stroke longer than an N-dash and is used variously, e.g. in front of a subspecific epithet instead of the full species name; it is produced by typing two hyphens with spaces in between, or in MSWord the code is alt + 0151. See also 2.10–2.12.

17.8 The use of '±' is preferred to c. or ca when describing shape, measurements and dimensions (see 13.12).

17.9 The decimal point replaces the comma in all units of measurement, e.g. leaves 1.0–1.5 mm long.

18 NEW TAXA

18.1 The name of a new taxon must be accompanied by at least a Latin diagnosis. Authors should not provide full-length Latin descriptions unless they have the required expertise in Latin at their disposal.

18.2 It is recommended that descriptions of new taxa be accompanied by a good illustration, **preferably a line drawing, or a photograph (second choice)** and a distribution map.

18.3 Example:

109. **Helichrysum jubilatum** *Hilliard*, sp. nov., *H. alsinoidei* DC. affinis, sed foliis ellipticis (nec spatulatis), inflorescentiis compositis a foliis non circumcinctis, floribus femineis numero quasi dimidium hermaphroditorum aequantibus (nec capitulis homogamis vel floribus femineis 1–3 tantum) distinguitur.

Herba annua e basi ramosa; caules erecti vel decumbentes, 100–250 mm longi, tenuiter albo-lanati, remote foliati. *Folia* plerumque 8–30 × 5–15 mm, sub capitulis minora, elliptica vel oblanceolata, obtusa vel acuta, mucronata, basi semi-amplexicauli, utrinque canolanato- arachnoidea. *Capitula* heterogama, campanulata, 3.5– 4.0 × 2.5 mm, pro parte maxima in paniculas cymosas terminales aggregata; capitula subterminalia interdum solitaria vel 2 vel 3 ad apices ramulorum nudorum ad 30 mm longorum. *Bracteae involucrales* 5-seriatae, gradatae, exteriores pellucidae, pallide stramineae, dorso lanatae, seriebus duabus interioribus subaequalibus et flores quasi aequantibus, apicibus obtusis opacis niveis vix radiantibus. *Receptaculum* fere laeve. *Flores* ± 35–41. *Achenia* 0.75 mm longa, pilis myxogenis praedita. *Pappi* setae multae, corollam aequantes, apicibus scabridis, basibus non cohaerentibus.

TYPE.—Northern Cape, 2817 (Vioolsdrif): Richtersveld, (–CC), ± 5 miles E of Lekkersing on road to Stinkfontein, kloof in hill south of road, annual, disc whitish, 7-11-1962, *Nordenstam 1823* (S, holo.: E, NH, PRE).

19 PROVINCES OF SOUTH AFRICA (Oct. 1996)

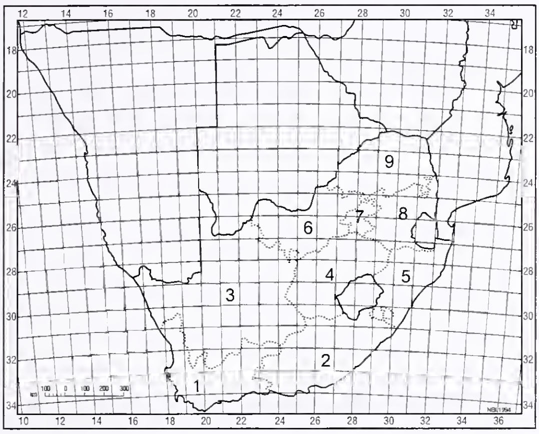


FIGURE 1.—1, Western Cape; 2, Eastern Cape; 3, Northern Cape; 4, Free State (previously Orange Free State); 5, KwaZulu-Natal (previously Natal); 6, North-West (previously northeastern Cape and southwestern Transvaal); 7, Gauteng (previously PWV); 8, Mpumalanga (previously Eastern Transvaal); 9, Limpopo (previously Northern Transvaal, Northern Province).

20 PROOFS

Only page proofs are normally sent to authors. They should be corrected in red ink and be returned to the editor **as soon as possible**. Do not add any new information.

21 REPRINTS

Reprints will no longer be issued. A PDF file of the article will be sent via the E-mail to authors and co-authors. It is for private use only, the SANBI copyright protects it from being used in another publication.

22 DOCUMENTS CONSULTED

Guides to authors of the following publications were made use of in the compilation of the present guide: *Annals of the Missouri Botanic Garden, Botanical Journal of the Linnean Society, Flora of Australia, Smithsonian Contributions to Botany, South African Journal of Botany* (including instructions to authors of taxonomic papers), *South African Journal of Science*.

23 ADDRESS OF EDITOR

Manuscripts should be submitted to: The Editor, *Bothalia*, South African National Biodiversity Institute, Private Bag X101, Pretoria 0001.

24 *FSA* CONTRIBUTIONS

24.1 Figures and text must conform to *Bothalia* format.

24.2 These articles will be considered as a full contribution to the *Flora of southern Africa* and will be listed as published in the '*Plan of Flora of southern Africa*', which appears in all issues of the *FSA* series.

25 PLACE NAMES

Ensure that local place names are correct. If in doubt, consult the Internet at

http://sagns.dac.gov.za/searchplacenamedatabase.asp

INDEX

abbreviation, 13.4, 13.15, 15.2, 15.14, 16.6
abstract, 2.1, 2.3, 2.4, 7, 13.2
acknowledgements, 2.4, 9
  address of
  authors, 2.3, 4
  editor, 23
alphabetical, 6, 10.9, 10.10, 15.3, 15.10, 15.13, 15.14, 15.15
Aluka image, 15.5, 17.2
ArcView GIS maps, 12.21
Arabic numerals, 11.1, 12.14, 13.13
author(s), 1.3, 2.1, 2.3, 4, 10.14, 12.17–12.19
  address, 2.3, 4
  citation, 5, 7.3, 13.2, 13.4, 14.2
  first, 10.2
  names, 2.3, 10.2, 10.7, 10.9, 10.11, 12.14, 13.7, 13.8, 14.3, 14.6, 15.7
  names of plant names, 5, 13.1, 13.2, 13.6, 13.7, 13.8, 14.6
  senior, 10.10
basionym, 14.10
book reviews, 1.1, 2.4
books, 10.4, 10.12, 10.13, 10.14
Bothalia, 1, 2.2, 11.2, 24.1
brief taxonomic articles, 15.8
BRUMMITT, R.K. & POWELL, C.E. (eds) 1992. *Authors of plant names*. Royal Botanic Gardens, Kew, 13.6
c., 13.12, 17.8
ca, 13.12, 17.8
Cape, 15.8, 18.3, 19
capital letters, 10.11, 11.2, 12.8, 12.9, 12.11, 13.20, 15.8
captions, 2.1, 2.4, 2.5, 11.2, 12.3, 12.9, 12.11–12.13, 12.15, 12.16, 12.23, 13.20
CD, 3.2, 3.8, 3.11
CDR file, 3.9
checklist, 13.2
chromosome number, 17.1, 17.2
chronological sequence, 10.3, 10.6, 10.9, 16.5
citation
  author, 5, 7.3, 13.2, 13.4, 14.2
  of specimens, 15
cm, 13.11
collection
  date, 15.1
  number, 13.9, 15.1, 15.2, 15.11, 15.13, 15.15
collective book, 10.14
collector, 13.9, 15.1, 15.2, 15.10, 15.13, 15.15
colon, 2.13, 14.4, 14.8
colour figures, 12.22
comma, 2.13, 15.3, 15.11, 15.13, 15.14, 17.9
compass directions, 13.15
composite figure, 12.8
congress proceedings, 10.14
contents, 8
CorelDraw up to version 14, 3.9
correspondence, 4
countries, 6.7, 15.8
deadline dates for submission of MS, 1.6

decimal point, 17.9
description and example of species treatment, 17
determinavit labels, 15.13
dimension ranges, 17.6
discussion, 2.4, 14.4
distribution maps, 12.20, 15.13, 18.2
DOC, 12.5
documents consulted, 22
dot maps, 12.20–12.23, 15.13, 18.2
double
  line spacing, 2.1
  space, 2.13
dpi (dots per inch), 12.3–12.6
drawing paper, 12.1
drawings, 3.7, 12.1–12.3
Eastern Transvaal, see Mpumalanga, 15.8, 19
edition, 13.15
editor, 1.5, 12.18, 13.15, 23
editorial
  board, 1.4
  policy, 1
electronic
  copy, 12.7
  files, 3, 3.2, 3.8–3.10, 12.3–12.6
  submissions of graphics, tables, 11, 12
E-mail, 3.2, 3.8, 21
encapsulated postscript file (EPS), 3.9, 12.21
EPS file, 3.9, 12.21
et al., 10.2, 13.5, 14.3, 17.2
example of
  new taxa, 18.3
  species treatment, 17.2
exclamation mark, 2.13, 15.4
EXCEL file, 12.4, 12.5
family name, 5, 6.7
fig., 14.7
figure(s), 12, 13.20, 14.7, 17.1
  colour, 12.22
  electronic submissions of, 12
  reduction of, 12.1, 12.3, 12.20
  returned, 12.18
file
  DOC, 12.5
  electronic, 3, 3.2
  extensions, 3.9
  CDR, 3.9
  EPS, 3.9, 12.21
  EXCEL, 12.4, 12.5
  JPG,
  PDF, 12.5, 21
  POWERPOINT, 12.5
  RTF, 3.3
  TIF, 3.9, 12.3–12.6
firewall, 3.8
first author, 10.2
first language, 1.3
flora, 10.14
Flora of southern Africa, 24
footnote, 3.4
Free State (previously Orange Free State), 15.8, 19
FSA contributions, 24
FTP site, 3.8
full stop, 2.13, 13.15, 13.16, 14.5
GARNOCK-JONES, P.J. & WEBB, C.J. 1996. The requirement to cite authors of plant names in botanical journals. *Taxon* 45: 285, 286, 13.6
Gauteng (previously PWV), 15.8, 17.2, 19
genera, 13.2
generic name, 13.3, 13.4, 16.6
geographical area, 7.2
granting agencies, 2.3
graphics, 3.7
  electronic submissions of, 12
graphs, 3.7, 12.4
grid reference system, 15.1, 15.8, 15.9, 15.11
headings, 3.4 3.6
sequence of, 2.3, 2.4
herbaria, 15.2, 15.3, 15.11, 15.13, 15.14
herbarium
  code, 15.11
  designations, 13.15, 15.15
  numbers, 15.2
  voucher specimens, 12.13, 13.19
here designated, 15.7, 17.2
histograms, 12.4
holo., 14.10, 15.3, 15.5, 17.2, 18.3
holotype, 15.3, 15.6
homonym, 16.2
hyphenated words, 2.9
hyphen, 2.10–2.12, 17.7
illegitimate names (nom. illeg.), 16.2
illustrations, 12.1–12.3, 12.8, 12.19, 14.8, 17.2
  previously published, 12.19
image files, 3.8–3.10
indentations, 3.4, 3.6
Index Herbariorum, 15.2, 15.14
index of names, 2.4
indices, 13.2
infrageneric taxa, 13.2
initials, 9, 10.5, 13.7
in prep., 10.14
in preparation, 10.14
in press, 10.14
International
  Code of Botanical Nomenclature, 13.7
  System of Units (SI), 13.11
invalidly published names, 16.3
italics, 3.5, 7.4, 10.12, 13.2, 13.3, 13.5, 13.9, 14.2, 15.1, 15.13, 15.15
journals, 10.4, 10.12, 10.14
  names of, 10.4, 10.13
JPG file, 12.3–12.6
justify, 2.8
keys, 2.16, 3.4, 13.16, 13.17, 13.18, 14.10
keywords, 2.3, 2.4, 6
KwaZulu-Natal (previously Natal), 15.8, 19
language, 1.3
Latin, 13.5, 16.4
  descriptions, 18.1
layout, 2.2, 12.6
lecto., 15.6, 15.7, 17.2
lectotype, 15.6, 15.7, 17.2
Limpopo (previously Northern Transvaal, Northern Province), 15.8, 19
line
  drawings, 2.1, 12.1, 18.2
  spacing, 2.1
literature
  references, 2.1, 10, 14.2, 14.3, 14.8, 14.9
  within synonymy, 14.8
localities outside southern Africa, 15.12
locality, 15.1, 15.10
location, 6.7
m, 13.11
magnification of figures, 12.12, 12.23
manuscript
  language, 1.3, 17.5
  requirements, 1.1, 1.2, 1.3, 2
  sequence, 2.3, 2.4
map
  ArcView GIS, 12.21
  distribution, 12.20, 15.13, 18.2, 19
  dot, 12.20
  neighbouring countries, 12.20
M-dash, 2.12, 17.7
mm, 13.11
margin, 2.1, 2.16, 3.4, 17.1
material, 2.3, 2.4
measurements, 13.11, 17.1, 17.3, 17.8, 17.9
methods, 2.4, 6.10.3
microfiche, 15.5
miscellaneous paper, 10.14
monograph, 2.4, 15.13, 16.1
Mpumalanga (previously Eastern Transvaal), 15.8, 19
MSWord, 2.7, 2.11, 2.12, 2.15, 3.3, 3.5, 17.7
name(s)
  collector's, 15.10
  illegitimate, 16.2
  invalidly published, 16.3
  of author(s), 2.3, 10.2, 10.7, 10.9, 10.11, 12.14, 13.7, 13.8, 14.3, 14.6, 15.7

name(s) (cont.)
  of authors of plant names, 5, 7.3, 13.1, 13.2, 13.6, 13.7, 13.8, 14.6
  of publications, 13.8
Natal, see KwaZulu-Natal, 15.8, 19
N-dash, 2.11, 10.7, 17.7
neighbouring countries, 12.20
neotype, 15.6, 15.7
new
  combinations, 7.4, 14.9
  taxa, 7.4, 13.2, 13.7, 15.7, 18
nom. illeg., 16.2
nom. nud., 13.5, 16.3, 16.4
non-breaking space, 2.7
normal style, 3.1
Northern
  Province, see Northern Transvaal, 15.8, 19
  Transvaal, see Northern Province, Limpopo, 15.8, 19
North-West, 15.8, 19
notes, 1, 2.4
  technical, 10.14
number
  chromosome, 17.1, 17.2
  herbarium, 15.2
numbering, 12.7, 13.13
  of figures, 12.7, 12.14, 17.1
  of keys, 13.16, 13.17
  of pages, 2.5
  of taxa, 14.5, 15.15
numerals, Arabic, 11.1, 12.14
obituaries, 1.1, 2.4, 10.7
Orange Free State, see Free State, 15.8, 19
original drawings/figures, 12.1–12.3, 12.7, 12.18
page charges, 1.5
paragraghs, 3.6
PDF file, 12.5, 21
pencil drawings, 12.2
permission (written)
  to copy material, 3.8
  to use previously published material (text and illustrations), 12.19
pers. comm., 10.5, 10.8
personal communications (pers. comm.), 10.5, 10.8
photocopies, 2.1, 12.6, 12.7
photograph, 3.7, 12.3, 12.5, 12.6, 12.15, 15.5, 18.2
  mosaic, 12.6, 12.7
plant
  collectors, 13.9
  name, 5, 13.4, 13.6, 13.7, 13.8, 14.6
plate (t.), 14.7
POWERPOINT file, 12.5
PRECIS (National Herbarium **PRE**toria **C**omputerised **I**nformation System), 13.1
prepositions, 6.4
proceedings, 10.14
proofs, 20
provinces, 6.7, 15.1, 15.8
  of South Africa, 15.8, 19
publications, 10.8, 13.8, 14.3
  name of, 14.2
  solo, 10.10
  year of, 10.9, 14.3
PWV, see Gauteng, 15.8, 19
quarter-degree squares, 15.1, 15.10
quotes, 2.15
reduction of
  figures, 12.1, 12.3, 12.20
  tables, 11.3
referees, 1.4
reference(s), 2.4, 2.5, 10.6, 10.7–10.9, 10.14
  figure, 12.10
  grid, 15.1, 15.8, 15.9, 15.11
  list, 10.5, 10.8, 10.9
  literature, 2.1, 10
report, 10.14
reprints, 21
requirements for manuscript, 2
results, 2.4
revision, 2.4, 8, 15.13, 16.1
RTF file, 3.3
scale bar, 12.7, 12.12
scan/scanning, 12.1, 12.3, 12.5
semicolon, 2.13, 10.3, 15.3, 15.13
senior author, 10.10
sequence of headings, 2.3, 2.4
short notes, 1.1, 2.4
space
  double, 2.13
  non-breaking, 2.7
  one, 2.16
special characters, 2.6
species treatment in taxonomic papers, 14.1–14.9
specimens examined, 2.4, 15.15
square brackets, 15.1, 17.2
STAFLEU, F.A. & COWAN, R.S. 1976–1988. *Taxonomic literature*. Vols 1–7, 10.13
style(s), 3.1, 3.4
submission of MS, 1.2, 1.6
subspecies treatment in taxonomic papers, 14.10
surnames, 13.10
synopsis, 13.2, 13.5, 15.1, 16.4
synonymy, 13.8, 14.8, 16.6
t., 14.3, 14.7, 17.2
table(s), 2.1, 2.4, 2.5, 11
  electronic submissions, 11
  of contents, 8
tablet (t.), 14.7
tabs, 3.4
taxa
  name of, 5, 7.4, 10.8, 13.2, 13.3
  new, 7.4, 13.2, 13.7, 15.7, 18
  numbering of, 14.5, 15.15
taxonomic
  articles/papers, 7.2, 10.8, 12.13, 12.20, 13.2, 13.6, 13.8, 13.11, 14
  revision, 8
  treatment
  species, 14.1–14.9
  subspecies, 14.10
taxonomy, 5, 7.3, 13.4
technical note, 10.14
text, 2.1, 3.7, 10.1, 10.4, 10.5, 10.8, 10.9, 11.1, 12.9, 12.10, 12.14, 12.17, 13, 15.13, 15.15, 16.4
thesis, 10.14
TIF file, 3.9, 12.3–12.6
times sign, 2.14
title, 2.3, 5, 6.9, 6.11
  of books, 10.4, 10.12, 10.13, 10.14
  of journals, 10.4, 10.12, 10.13, 10.14
  page, 2.3, 2.5
tracked changes, 3.11
Transvaal, 15.8, 17.2, 19
type, 15.2, 15.4, 15.7, 16.1, 16.5, 17.2
  here designated, 15.7, 17.2
  not designated, 15.7
  specimen, 15.1
units of measure, 13.11, 13.15, 17.9
unpublished article, 10.14
voucher(s) specimens, 12.13, 13.19, 15.13, 15.4
World list of scientific periodicals, 10.13
year of publication, 10.9, 14.3

ANNUAL SUBSCRIPTION (2010)

SADC R220.00 Other countries US$55.00

TWO-YEAR SUBSCRIPTION

2009/10: SADC R450.00 Other countries US$110.00
2010/11: SADC R450.00 Other countries US$110.00

BOTHALIA SPECIALS

Colour plates in Bothalia	Price per volume
Vol. 9, 3 & 4: 27 plates of *Kniphofia* spp. by Cythna Letty and others	SADC: R30.00 / Other: US$8.00
Vol. 16,1: *Kniphofia splendida* by Cythna Letty	SADC: R10.00 / Other: US$3.00
Vol. 27,2: *Nivenia parviflora* by Fay Anderson	SADC: R85.00 / Other: US$22.00
Vol. 28,2: *Cyrtanthus erubescens* by M.E. Connell	SADC: R85.00 / Other: US$22.00
Vol. 29,2: *Gladiolus rhodanthus* by Auriol Batten	SADC: R85.00 / Other: US$22.00
Vol. 30,1: *Clivia miniata* by Barbara Jeppe	SADC: R85.00 / Other: US$22.00
Vol. 32,1: *Clivia mirabilis* by Auriol Batten	SADC: R95.00 / Other: US$24.00
Vol. 33,2: *Cyrtanthus macmasteri* by Auriol Batten	SADC: R95.00 / Other: US$24.00
Vol. 33,2: *Erica × willmorei* by R. Mills	SADC: R95.00 / Other: US$24.00
Vol. 33,2: *Jamesbrittenia bergae* by Gillian Condy	SADC: R95.00 / Other: US$24.00
Vol. 37,1: *Cyrtanthus aureolinus* by Vicki Thomas	SADC: R120.00 / Other: US$30.00

Contents to vols 1–20

by H.F. Glen, B.A. Momberg & E. Potgieter (1991)

A brief history of Bothalia; a list of all papers published; a list of all authors, co-authors, keywords and titles; and tables with publication dates, major subjects covered and some information on authors.
Price: SADC countries, R15.00 / Other countries US$4.00

Contents to vols 21–25

by B.A. Momberg & J.M. Mulvenna (1996)

List of papers alphabetically arranged according to senior author and dates and including all co-authors in alphabetical listing. Subject index compiled from keywords and titles, with reference to individual articles.
Price: SADC countries, R15.00 / Other countries US$4.00

Contents to vols 26–30

by B.A. Momberg (2000)

List of papers alphabetically arranged according to senior author and dates and including all co-authors in alphabetical listing. Subject index compiled from keywords and titles, with reference to individual articles.
Price: SADC countries, R18.00 / Other countries US$5.00

Contents to vols 31–37 (2001–2007)

by B.A. Momberg (2008)

List of papers alphabetically arranged according to senior author and dates and including all co-authors in alphabetical listing. Subject index compiled from keywords and titles, with reference to individual articles.
Price: SADC countries, R40.00 / Other countries US$8.00

Set of all available issues

up to and including: Volume 39; Contents to Vols 1–20; 21–25; 26–30; and Vols 31–37; all existing indices.

Price: SADC countries, R500.00 / Other countries US$125.00

The history of the Botanical Research Institute

by Denise Fourie

a reprint of this article in *Bothalia* 28,2 with an attractive cover.
Price: SADC countries, R30.00 / Other countries US$8.00

All prices include VAT. Prices are subject to change from time to time. Postage is excluded. Please consult the latest catalogue.
Available from: The Bookshop, South African National Biodiversity Institute, Private Bag X101, Pretoria 0001, RSA
Tel. (012) 843-5001 • Fax (012) 804-3211 • email: bookshop@sanbi.org.za

BOTHALIA

Volume 40,2 Oct. 2010

CONTENTS

1. *Moraea vuvuzela* and *M. intermedia* (Iridaceae–Iridoideae), two new species from western South Africa, and some nomenclatural changes and range extensions in the genus. P. GOLDBLATT and J.C. MANNING 147
2. Taxonomic notes on the Clathraceae (Phallales: Phallomycetidae) *sensu* Bottomley and a new key to the species in southern Africa. J.C. COETZEE 155
3. Two new species of *Nemesia* (Scrophulariaceae) from the southern Cape, South Africa. K.E. STEINER 161
4. Notes on African plants:
    - Asphodelaceae. *Bulbinella calcicola*, a new species from Saldanha Bay, Western Cape. J.C. MANNING and P. GOLDBLATT 197
    - Asteraceae. *Berkheya chrysanthemoides* and *Heterorhachis hystrix*, two new species of Arctotideae–Gorteriinae from the southwestern Cape. J.C. MANNING, P.O. KARIS, P. GOLDBLATT and N.A. HELME 185
    - Asteraceae. *Senecio comptonii* and *S. esterhuyseniae*, two new species of *Senecio sens. lat.* (Senecioneae) from the Cape Floristic Region. J.C. MANNING and P. GOLDBLATT 193
    - Colchicaceae. *Colchicum albofenestratum*, a new species from Namaqualand, South Africa. D.A. SNIJMAN and J.C. MANNING 175
    - Euphorbiaceae. A new name for *Euphorbia chamaeclada* from Angola. P.V. BRUYNS 178
    - Fabaceae. Taxonomic status of *Elephantorrhiza rangei* (Mimosoideae). A. GROBLER and A.E. VAN WYK 183
    - Iridaceae. *Geosiris albiflora* (Geosiridoideae), a new species from the Comoro Archipelago. P. GOLDBLATT and J.C. MANNING 169
    - Lycoperdaceae–Gasteromycetes. Taxonomic and nomenclatural notes on Bottomley's 'doubtful, unknown and insufficiently described' species of *Lycoperdon*. J.C. COETZEE and A.E. VAN WYK 172
    - Oxalidaceae. Rediscovery and phylogenetic position of the rare *Oxalis purpurata*. K.C. OBERLANDER, L. L. DREYER and F. ROETS 177
    - Poaceae. Two new species of *Helictotrichon* (Pooidae: Aveneae) from South Africa. A.C. MASHAU, L. FISH and A.E. VAN WYK 179
    - Poaceae. The correct author citation of *Helictotrichon* (Pooidae: Aveneae). A.C. MASHAU, L. FISH and A.E. VAN WYK 184
    - Poaceae. A new species of *Pentameris* from Jonaskop, South Africa. H.P. LINDER 190
    - Rubiaceae. A new species of *Didymosalpinx* and a new species of *Oxyanthus* from Mozambique and Tanzania. J.E. BURROWS and S.M. BURROWS 200
    - Vitaceae. The status of *Cyphostemma unguiformifolium* in southern Africa. E. RETIEF and N.R. CROUCH 167
5. Checklist of ferns and seed plants of the Golden Gate Highlands National Park, South Africa. M.E. DAEMANE, B-E. VAN WYK and A. MOTEETEE 205
6. How homogeneous is West Coast Renosterveld? Implications for conservation. I.P. NEWTON and R.S. KNIGHT 219
7. Obituary: Michael John Wells (1935–2010). O.A. LEISTNER 227
8. South African National Biodiversity Institute: publications 1 January 2009 to 31 December 2009. Compiler: B.A. MOMBERG 233
9. Guide for authors to *Bothalia* 239

Abstracted, indexed or listed in • AETFAT Index • AGRICOLA • AGRIS • BIOSIS: *Biological Abstracts/RRM* • CABS • CABACCESS • CAB ABSTRACTS • ISI: *Current Contents, Scisearch, Research Alert* • *Kew Record of Taxonomic Literature* • *Taxon*: reviews and notices.

ISSN 006 8241

© Published by and obtainable from: South African National Biodiversity Institute, Private Bag X101, Pretoria 0001, South Africa.
Tel. (012) 843-5000. Fax (012) 804-3211. e-mail: bookshop@sanbi.org website: www.sanbi.org. Typesetting and page layout: D. Marce.
Printing: Seriti Printing (Pty) Ltd, P.O. Box 24829, Gezina, 0031 Pretoria.